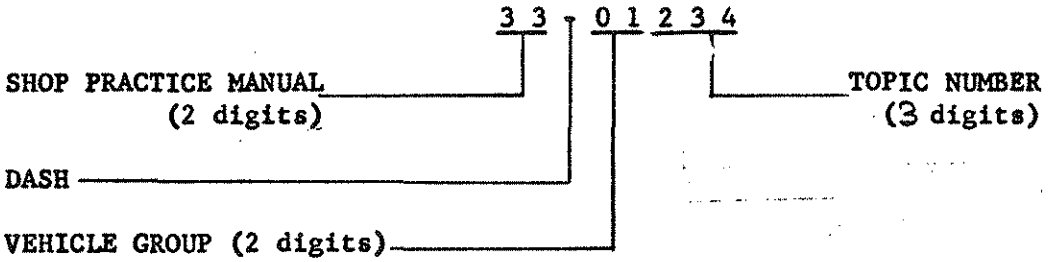
VEHICLE GROUP DESCRIPTION	ENGINEERING MANAGER
01 - ENGINE & ENGINE ACCESSORIES 05 - COOLING 22 - A/C COMPRESSOR, MOUNTINGS, & CONDENSOR	STEVE HEILESON
02 - CLUTCH & CONTROLS 03 - AIR INTAKE, FUEL TANKS & MOUNTINGS 04 - EXHAUST & MOUNTING 06 - BATTERY BOX & COVER 07 - TRANSMISSION & CONTROLS 09 - DRIVESHAFT 12 - AIR RESERVOIR & MOUNTINGS 21 - BUMPERS 22 - FIFTH WHEELS, DECK PLATES, MUD FLAPS & QUARTER FENDERS	VINCE MCHORSE
10 - FRONT AXLES 11 - REAR AXLES 13 - WHEELS & TIRES	DENISE REEVES
14 - STEERING 15 - FRAME & CROSSMEMBERS 16 - SUSPENSIONS 22 - TOWING DEVICE	DAVE RUUHELA
06 - ELCTRICAL 12 - AIR BRAKE CONTROLS 22 - INSTRUMENTS, GAUGES, & RADIO	DOUG LOUTZENHISER
06 - ELECTRONIC ENGINE CONTROLS	TOM YOUNG
17 - HOOD & GRILLE 18 - CAB TILT SYSTEM 22 - ROOF FAIRINGS & CAB SIDE EXTENDERS	ERIC MACDONALD
18 - CAB SHELL 22 - SLEEPER BOX SHELL	PETE STRAUSE
18 - CAB UPHOLSTERY 22 - SEATS & DASH	BRUCE KOEPKE
22 - HEATER, VENT, & AIR CONDITIONING	MIKE PRANGER

Compiled	A.L.R.	SHOP PRACTICE GROUP INDEX	33-00011
Approved	[illegible]		
Issued	10-14-68		
Revised	3-1-85	Chng Ltr: C FREIGHTLINER CORPORATION PORTLAND, OREGON	

GENERAL

Information is arranged in this book first by Vehicle Group Number; then by Topic; and finally by suitable Subdivisions of the Topic. The number appearing in the upper right corner box is composed as follows:



VEHICLE GROUPS

NO.	NAME	NO.	NAME
00	Vehicle	12	Brake
01	Engine	13	Wheel
02	Clutch	14	Steering
03	Fuel & Air Intake	15	Frame
04	Exhaust	16	Suspension
05	Cooling	17	Hood
06	Electrical	18	Cab
07	Transmission	21	Bumper
09	Drive Line	22	Instrument & Accessory
10	Front Axle		
11	Rear Axle		

PRACTICE NO.	DESCRIPTION
33-00102	LUBRICATION
33-00105	FLEXIBLE HOSE ASSEMBLY
33-00108	WELDING
33-00109	GENERAL VEHICLE, FASTENERS
33-00110	TENSION SPRINGS
33-00111	ADHESIVE APPLICATION, STUDS AND FASTENERS
33-00112	LABEL & DECAL APPLICATION
33-00113	PAINTING & PRIMING
33-00115	ANTI CORROSION COMPOUNDS
33-00119	RELIEF CUTOUTS
33-00120	SHIP LOOSE PARTS ON GLIDERS
33-00121	DEBURRING & EDGE BREAKING
33-00122	FORMING IMPERFECTIONS
33-00124	GROUND CLEARANCE
33-00130	AIR LINES, COLOR CODING

PRACTICE NO.	DESCRIPTION
33-00501	CERTIFICATION LABELS, GENERAL
33-00510	CERTIFICATION LABELS, U.S. TRACTORS
33-00515	CERTIFICATION LABELS, U.S. TRUCKS
33-00520	CERTIFICATION LABELS, GLIDERS
33-00525	CERTIFICATION LABELS, SALES CABS
33-00530	CERTIFICATION LABELS, CANADIAN TRACTORS
33-00535	CERTIFICATION LABELS, CANADIAN TRUCKS
33-00540	CERTIFICATION LABELS, CANADIAN GLIDERS
33-00545	CERTIFICATION LABELS, CANADIAN SALES CABS
33-00550	CERTIFICATION LABELS, U.S. TRUCKS, COMPLETE
33-00555	CERTIFICATION LABELS, TIRE & RIM
33-00560	CERTIFICATION LABELS, EXHAUST EMISSIONS
33-00565	CERTIFICATION LABELS, NOISE EMISSIONS
33-00615	CERTIFICATION LABELS, U.S. EXPORT
33-00620	CERTIFICATION LABELS, CANADIAN EXPORT
33-00625	ROUTING, FLEXIBLE LINE

1. PRELUBRICATION OF CLOSE FIT PARTS

Closely mating surfaces must be lightly lubricated **prior to** assembly to avoid corrosion and seizure leading to subsequent **difficulty** in dissassembly and servicing.

EXAMPLES:

Spring Pin and Bushing
Bearing Cone and Axle Tube

K 2. GENERAL VEHICLE LUBRICATION

All vehicles are to be lubricated as directed on the lubrication chart (forms E47 & E54). See Page 2 and 3 for samples.

	COMPONENT		API	SAE	LUBE TYPE	F/L SPEC	QUANTITY
	ENGINE	CUMMINS	CC CD SE	15W 40	HEAVY DUTY ENGINE OIL	48-02277-000	AS PER SHOP PRACTICE 33-01106
		CAT(STD)	CC CD	30		48-02276-030	
		CAT(OPTIONAL)	CC CD SE	15W - 40		48-02277-000	
		DDD 92 SERIES	CC CD	30		48-02276-030	
		DDE SERIES 60	CC CD SE	15W - 40		48-02277-000	
	MAIN TRANSMISSION	FULLER, SPICER	CC	50	HEAVY-DUTY ENGINE OIL	48-02179-050	FILL TO PLUG
		ALLISON AT, MT, HT SERIES			"DEXRON"/DEXRON II ATF	48-02182-000	AS PER SHOP PRACTICE 33-07104
		ALLISON CL(B)T			HYD. TRANS FLUID TYPE "C-3"	48-02182-200	
	AUXILIARY TRANSMISSION	SPICER, FULLER	CC	50	HEAVY-DUTY ENGINE OIL	48-02179-050	FILL TO PLUG
	TRANSFER CASE	ABOVE 30°F	GL1	90	STRAIGHT MINERAL GEAR OIL	48-02180-090	FILL TO PLUG
		BELOW 30°F		140		48-02180-140	FILL TO PLUG
K	FRONT DRIVE AXLE	EATON, ROCKWELL	GL5	80W 90	MULTI-SERVICE GEAR OIL	48-02174-890	FILL TO PLUG
	DRIVELINE	SLEEVE YOKES & U-JOINTS			CHASSIS GREASE	48-00109-001	AS REQUIRED
K	REAR DRIVE AXLE	EATON, ROCKWELL	GL5	80W 90	MULTI-SERVICE GEAR OIL	48-02174-890	FILL TO PLUG ***
	MULTI-SPEED	EATON	SD	10	ENGINE OIL **	48-02195-010	FILL TO PLUG
K	INTER-AXLE SHIFT	ALL TANDEMS	GL5	80W 90	MULTI-SERVICE GEAR OIL	48-02174-890	FILL TO PLUG
K	AXLE HUBS	OIL SEALS	GL5	80W 90	MULTI-SERVICE GEAR OIL	48-02174-890	FILL TO PLUG
	FRONT DRIVE AXLE JOINTS				MULTI-PURPOSE WHEEL BEARING GREASE	48-02191-000	2.0 LBS. PER JOINT
K	MAN.STEER.GEAR		GL5		M.S. GEAR OIL	48-02174-890	FILL TO PLUG
	F/L SHIFT BOX	FIRST ADD			ALCOHOL	48-02190-000	1/4 PINT
		THEN	SD	20	HEAVY DUTY ENGINE OIL	48-02195-020	FILL TO PLUG

** Optional Lube: SAE 10W-40 Oil Per 48-2297.

*** See 33-11115 For fill plug data.

	COMPONENT	API	SAE	LUBE TYPE	F/L SPEC.	QUANTITY
	Spring & Shackle Pins Kingpins & Bushings Tie Rod Draglink Clutch Cross Shaft Shift Shaft(s) Brake Camshafts Slack Adjusters Fifth Wheel Pivot Pins Equalizer			CHASSIS GREASE	48-00109-001	AS REQUIRED
K	Clutch Release Bearing			Hi Temp Wheel Bearing Grease	48-02191-002	as per 33-02102
	Power Steering Reservoir		15/40	Engine Oil	48-02277-000	Fill to mark on reservoir
	Tilt Pump			Hydraulic Fluid	48-02207-000	Fill as per 33-18120
K						
	Battery Terminals			Jax Battery Saver	48-00115-000	As Required
	Radiator			Anti-Freeze	48-22880-000	As per radiator inst.
	Oil Mist	SD	20	Heavy Duty Engine Oil	48-02195-020	Fill to mark on reservoir
K	Multi-Luber			Multi-Service Oil	48-02393-000	Fill to mark on reservoir
K						
	Air Cleaner, Dry	INSTALL ELEMENT & SEAL PER 33-03207				
	Engine Oil Level Regulator Reservoir			Heavy Duty Engine Oil	Same as Engine	Fill to 1/2" Below Top of Sight Glass
	Fuel Tank- Single Suction & Return					
	LH TANK: CUMMINS CAT DDE 6I71			#2 FUEL	48-00114-001	15 gallons
	RH TANK: DDE "V" ENG					
	Fuel Tank - Dual Suction & Return			#2 FUEL	48-00114-001	15 Gallons L.H. Tank

COMPILED	F F	SHOP PRACTICE FLEX HOSE ASSEMBLY	SECTION NUMBER 33-00105
APPRV	JAKE		
ISSUE DATE	06/25/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0000-001 FOR FLEX HOSE ASSEMBLY.

Compiled	F. Freer	SHOP PRACTICE FLEX HOSE ASSEMBLY*	33-00105
Approved	JAKE		
Issued	6-25-87	FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1
Revised		Chg Ltr	

A. GENERAL

Use of proper assembly procedures and tooling specifically suited to the size, type, and brand of flexible tubing assemblies, are essential to trouble-free hose installations. The following may be considered minimal requirements in preparation of flexible hose assemblies for use on vehicles.

B. CLEANLINESS

Fittings and tubing must be clean. Cleanliness of the outside of the hose is important to prevent transfer inside of foreign matter (dust, chips, grease, etc.). Clean storage and handling are very helpful.

In case cleaning of hose is necessary, use means outlined in the following table:

FLEX LINES	CLEANING PROCEDURE
Air (Brake)	Blow out with shop air
Fuel	Air and/or solvent as required
Refrigeration (Freon)	Nitrogen
Oil (lubrication)	Air and/or solvent as required
Hydraulic Fluid	Air, solvent, hydraulic fluid as

C. TOOLS

Use the proper tools for making up hose assemblies.

D. ASSEMBLY

1. All components of a reusable end fitting must be of the same manufacture as the wire braid hose that they are attached to.
2. Follow manufacturer's recommendations in regard to assembly methods, unless directed otherwise by Corporate Engineering.

E. PLASTIC TUBING

Careful installation of air piping is especially important for plain plastic material, such as nylon. Nylon tubing is notch sensitive, expecially in cold weather, so replace it if nicked or cut, even if not leaking, to avoid failure in service.

F. SPECIFIC APPLICATIONS

For specific hose applications (power steering, fuel lines, etc.) refer to the appropriate group.

G. HOSE CLAMPING

1. Hoses shall be clamped to minimize sagging or whipping under vehicle operating conditions. Appropriate clamps shall be used based on hose size and material. Silicone hose shall use liner style clamps to reduce the cutting effect on the soft silicone material.

2. Parallel Hoses:

   Single "Double Hose" Clamp: Can be used along the frame rails and the inner tunnel sides of the engine compartment. In general, a single clamp can be used for two hoses where the hoses are somewhat protected and clamping is for one hose routed above the other (i.e., gravity or vibrations do not want to bend the clamp away from the attachment point).

   Two "Single Hose" Clamps: Under the LH and RH decks, to any axle, under the sleeper box, on the cab roof, and up the cab back skin. These areas impose a bending or twisting load on the clamps and two "single hose" clamps are required to do the job adequately.

H. CAUTION:

B

On vehicles equipped with Spicer transmissions, refer to 33-07106.

COMPILED	F. F
APPRV	JAKE
ISSUE DATE	11/06/87
REV DATE	07/29/96
CHG LTR	A

SHOP PRACTICE

WELDING

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-00108

PAGE
1 OF 1

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0000-002 FOR WELDING.

A. **GENERAL**

Welding must conform to provisions of the latest revision of any pertinent process specification.

General coverage, however, is given to the following in the indicated pages of this Manual:

Frame, Aluminum	33-15102
Frame, Steel	33-15101
Frame Inserts, Steel	33-15111

Do not weld to repair defects (pits, cracks, etc.), nor to attach any casting of Aluminum Alloy 220 (=ASTM G10A, =SAE No. 324). (Ref. SAE Info. Report J452, ASTM B26 and B179.)

On Engineering drawings untoleranced weld dimensions are minimum size and length.

Continuous fillet welds can replace intermittent fillet welds except where they interfere with mating parts in areas stated on the print. The amount of oversized weld should be kept to a minimum to limit distortion, internal stress and cost (Ref. AWS Vol. 5, 7th Edition).

B. Welding on a Vehicle

Before welding on a vehicle the electronic clock, if present, must be disconnected. If not, clock failure will result.

D. ESTABLISHING WELDING CONTROL SETTINGS FOR SPOT WELDING

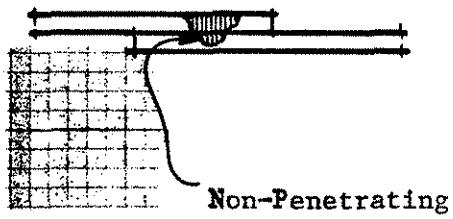
Table 1. lists control settings useful in welding various aluminum sheet thickness combinations. This will serve as a starting point for the user. Exact control settings should be worked out on trial pieces.

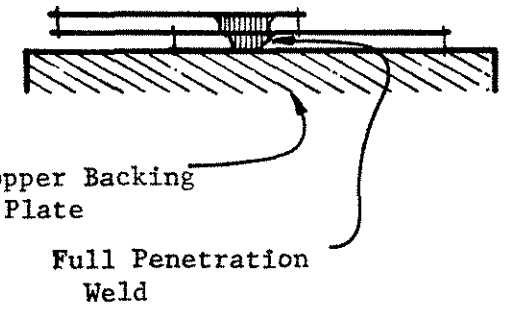
TABLE 1 - WELDING PARAMETER GUIDE FOR VARIOUS SHEET THICKNESSES*

SHEET THICKNESS, IN.		NONPENETRATING WELDS			FULL-PENETRATION WELDS		
TOP	BOTTOM	OPEN CIRCUIT VOLTAGE VOLTS	WIRE FEED, IPM**	WELD TIME, SEC	OPEN CIRCUIT VOLTAGE, VOLTS	WIRE FEED IPM	WELD TIME SEC
0.020	0.020	---	---	---	27	250	0.3
0.020	0.030	---	---	---	28	300	0.3
0.030	0.030	25.5	285	0.3	28	330	0.3
0.030	0.050	25.5	330	0.3	31	430	0.3
0.030	0.064	30	360	0.3	31	450	0.3
0.050	0.050	31	385	0.4	32	450	0.4
0.050	0.064	32	400	0.4	32	500	0.4
0.064	0.064	32	420	0.4	32	550	0.5
0.064	0.125	32.5	650	0.5	34.5	675	0.5
0.064	0.187	35	700	0.5	39	700	0.5
0.064	0.250	39	775	0.5	41	800	0.5
0.125	0.125	39.5	800	0.5	41	850	0.6
0.125	0.187	41	850	0.75	41	900	0.75
0.125	0.250	41	900	1.0	---	---	---

* Overlap Joints -.047 in. dia. 5554 Electrode.

** Welding Current in Amperes is Approximately Equal to 1/2 X (Wire Feed, in IPM) of .047 in. dia. Wire





E. CHANGE OF SHEET OR FULLER METAL ALLOY

Changing sheet or filler requires changes in the control settings to produce equal penetration. Table 2. shows that these variations can easily be compensated for by adjustment of the wire feed control. Trial pieces used for establishing the control settings should be the same alloy as the production pieces.

TABLE 2 - WELDING PARAMETER GUIDE FOR VARIOUS SHEET AND FILLER METAL ALLOYS *

Open Circuit Voltage: 32
Weld Time: 0.4 sec-nonpenetrating welds
0.5 sec-full-penetration welds

Nonpenetrating welds, Wire feed, ipm, filler metal alloy

sheet alloy	1100	2319	4043	554	5556
1100	475	---	400	---	550
2219	---	380	390	---	500
3003	450	---	400	---	560
5154, 5052	---	---	400	440	475
6061	---	---	390	420	475
6063, 2 EC	440	---	385	450	500
7075	---	400	400	440	500
Full-penetration welds**					
All sheet alloys	550	500	500	550	600

* Overlap joints; 0.064 in. sheet; 0.047 in. dia. electrode.
** Against a copper backing plate.

F. SHIELDING GAS

1. Normally use argon shielding for aluminum gas metal arc spot welding. The gas flow rate should be approximately 20 cubic feet per hour.

2. The use of helium shielding is for very thin aluminum sheets or for non-penetrating welds using .125 inch thick sheets.

G. COMPATIBLE ALLOY COMBINATIONS

Compatible combinations of base metal and filler metal will minimize weld cracking. Table 3. lists crack resistant combinations.

TABLE 3 - WELD CRACKING RESISTANCE FOR GAS METAL-ARC SPOT WELDING

Aluminum Base Metal Alloys	Good Filler Metal Alloys	Usable Filler Metal Alloys
1100, 1060, EC	4043, 1100, 5356, 5556[a]	------
2014, 2024, 2219	2319, 4043	2014
3003	4043, 1100, 5356, 5556[a]	------
5005, 5050	4043, 5356, 5556[a]	------
5052, 5086, 5154	4043, 5356, 5556[a]	5254[b], 5554
5083, 5456	4043, 5356, 5556[a]	5554
5454	4043, 5356, 5554, 5556[a]	5254[b]
6061, 6062, 6063, 2EC	4043, 5356, 5556[a]	5254[b], 5554
7075, 7178	4043	2319, 5554, 5556[a]

[a] - 5183 may be used in place of 5556.
[b] - 5154 may be used in place of 5254.

H. RESISTANCE SPOT WELDING GENERAL GUIDE LINES

For resistance spot welding shop practice guide lines on aluminum,steel, magnesium,etc.refer to "Job instruction guide - basics of spot welding,mjt 814.00" manual

DRAWN	ERK	TITLE	ITEM NUMBER
APPRV	ANF	SHOP PRACTICE FASTENERS	33-00109
DATE	06/07/85	FREIGHTLINER CORPORATION PORTLAND, OREGON	SHEET 1 OF 12

1. GENERAL

ALL TYPES OF FASTENERS WILL CONFORM TO THE LATEST ANSI/IFI/SAE/DIN/ISO STANDARDS.

2. STANDARD THREADED FASTENERS

FREIGHTLINER STANDARD FASTENERS REFERENCED BELOW ARE TO BE USED IN ALL APPLICATIONS WHERE ENGINEERING DRAWINGS OR BILLS OF MATERIAL DO NOT CALL OUT A SPECIFIC NUT OR BOLT.

A. SIZES 5/16" AND SMALLER

CASE HARDENED, UNC, FLANGED HEXAGON HEAD SCREWS AND DEFORMED THREAD PREVAILING TORQUE NUTS AND STEEL WASHERS.

B. SIZE 3/8"

SAE GRADE 8, UNC, FLANGED HEX HEAD CAPSCREWS AND FLANGED LOCK NUTS.

C. SIZES 1/2" AND LARGER

SAE GRADE 8, UNC, HEX HEAD CAPSCREWS WITH DEFORMED THREAD PREVAILING TORQUE NUTS AND HARDENED STEEL WASHERS.

3. FINISH OF FASTENERS

SAE GRADE 5 SCREWS ARE STANDARD WITH ZINC PLATE AND WAX FINISH AND NUTS ARE STANDARD WITH A CADMIUM AND WAX FINISH.

SAE GRADE 8 HEXAGON CAPSCREWS ARE STANDARD WITH PHOSPHATE AND OIL FINISH. PREVAILING TORQUE HEXAGON NUTS ARE STANDARD WITH A CADMIUM AND WAX FINISH.

STEEL WASHERS ARE STANDARD WITH ZINC PLATE.

FASTENERS LOCATED AGAINST CHROME PLATE, UNPAINTED ALUMINUM, OR STAINLESS STEEL SURFACE (E.G. BUMPER) ARE TO BE STAINLESS STEEL.

CHG	JOB/RLSE NO	DATE	BY	REVISION
F	PA2024-55	12/20/90	ERK	REVISED AND REDRAWN

ORIGINAL

4. FASTENER GRADE IDENTIFICATION

4.1 INCH THREAD FASTENERS

REFER TO IFI 100/107 FOR LOCKNUTS, SAE J995 FOR NON-LOCKING NUTS, AND SAE J429 FOR HEX CAPSCREWS.

A. HEX BOLTS AND CAPSCREWS

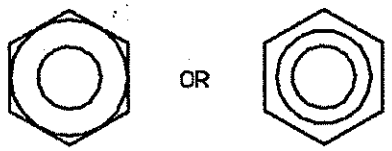
GRADE 2 GRADE 5 GRADE 8 GRADE 8.2

GRADE 2 BOLTS HAVE NO GRADE MARKINGS. DO NOT INSTALL WITHOUT ENGINEERING APPROVAL.

IN ADDITION TO THE GRADE MARKINGS, THE BOLT HEAD MUST ALSO CARRY THE MANUFACTURER'S TRADEMARK OR IDENTIFICATION.

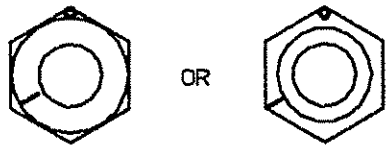
B. HEX NUTS

SAE GRADE 2 NUTS HAVE NO GRADE MARKINGS. DO NOT INSTALL WITHOUT ENGINEERING APPROVAL.



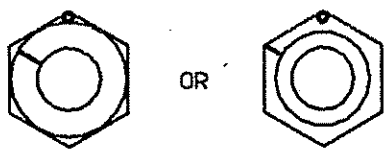
OR

GRADE 2 NUT



OR

GRADE 5 NUT



OR

GRADE 8 NUT

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F	PA2024-55	12/20/90	ERK	REVISED AND REDRAWN

ORIGINAL

DRAWN	ERK	TITLE	ITEM NUMBER
APPRV	ANF	SHOP PRACTICE FASTENERS	33-00109
DATE	06/07/85	FREIGHTLINER CORPORATION PORTLAND, OREGON	SHEET 3 OF 12

4. FASTENER GRADE IDENTIFICATION (CONT.)

4.1 INCH THREAD FASTENER (CONT.)

B. HEX NUTS (CONT.)

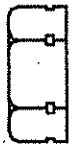
NOTE: HEX NUTS MAY CARRY THEIR GRADE IDENTIFICATION ON THE FLANGE SURFACE INSTEAD OF THE NUT HEAD OR CHAMFER SURFACE AS SHOWN.

GRADE A NUT (STRENGTH COMPATIBLE WITH GRADE 2 BOLT)

OR

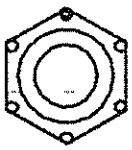
NO IDENTIFICATION MARKS OR NOTCHES.

GRADE B NUT (STRENGTH COMPATIBLE WITH GRADE 5 BOLT)

OR


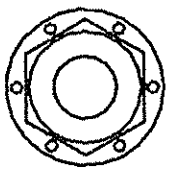
THREE IDENTIFICATION MARKS AT 120° AS SHOWN OR 6 NOTCHES.

GRADE C NUT (STRENGTH COMPATIBLE WITH GRADE 8 OR GRADE 8.2 BOLT)


OR

SIX IDENTIFICATION MARKS AT 60° AS SHOWN. OR 12 NOTCHES.

GRADE G NUT (FLANGED LOCK NUT, STRENGTH COMPATIBLE WITH GRADE 8 OR GRADE 8.2 BOLT)



SIX IDENTIFICATION MARKS AS SHOWN.

EACH IDENTIFICATION MARK MAY BE A DOT, LINE, PAIR OF DOTS OR LINES, OR ANY OTHER SYMBOL AT THE VENDORS OPTION.

USE A NUT MATCHING THE GRADE OF THE BOLT TO WHICH IT IS APPLIED.

CHG	JOB/RLSE NO	DATE	BY	REVISION
F	PA2024-55	12/20/90	ERK	REVISED AND REDRAWN

ORIGINAL

DRAWN	ERK	TITLE SHOP PRACTICE FASTENERS	ITEM NUMBER 33-00109
APPRV	ANF		
DATE	06/07/85	FREIGHTLINER CORPORATION PORTLAND, OREGON	SHEET 4 OF 12

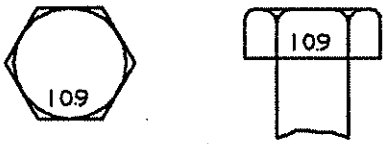
4. FASTENER GRADE IDENTIFICATION (CONT.)

4.2 METRIC THREAD FASTENER

REFER TO ISO 898/1 FOR METRIC CAPSCREWS AND ISO 898/2 FOR METRIC NUTS.

A. HEXAGON CAPSCREWS

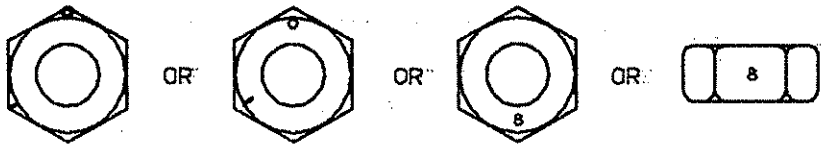
CLASS 8.8



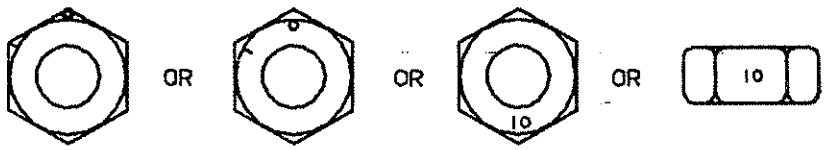
CLASS 10.9

IN ADDITION TO THE GRADE MARKINGS, THE BOLT HEAD MUST ALSO CARRY THE MANUFACTURER'S TRADEMARK OR IDENTIFICATION.

B. HEXAGON NUTS



CLASS 8 NUT



CLASS 10 NUT

USE ONLY CLASS 8 NUTS WITH CLASS 8.8 CAPSCREWS AND USE ONLY CLASS 10 NUTS WITH CLASS 10.9 CAPSCREWS.

CHG	JOB/RLSE NO	DATE	BY	REVISION
F	PA2024-55	12/20/90	ERK	REVISED AND REDRAWN

ORIGINAL

5. MOUNTING TUBING CLIPS WITH CAPSCREWS SERVING OTHER PURPOSES

CAPSCREWS USED TO RETAIN GASKETED COVERS ARE FREQUENTLY FOUND TO BE A CONVENIENT MEANS FOR MOUNTING TUBING CLIPS OR OTHER (SMALL) COMPONENTS. IF SUCH USE IS TO BE MADE OF THEM, CERTAIN PRECAUTIONS MUST BE TAKEN TO ASSURE THAT THE RESULTS WILL BE SATISFACTORY.

A. MAKE SURE THE MOUNTING TAB UNDER THE CAPSCREW HEAD IS NOT OF SUCH SOFT MATERIAL THAT THE SCREW WILL LOOSEN UNDER VIBRATION.

B. MAKE SURE THE CAPSCREW IS LONG ENOUGH FOR THE ADDED GRIP AND, IF A LONGER SCREW IS USED, THAT THE NEW CAPSCREW IS NOT SO LONG AS TO CAUSE INTERFERENCE AT THE TIP.

C. MAKE SURE THAT A SEAL FUNCTION IS NOT LOST BY THE ADDITION OF THE NEW COMPONENT.

D. AVOID MOUNTING ADDITIONAL PARTS UNDER CAPSCREWS USED FOR PURPOSES SUCH AS SEALING OIL SUMPS, OR PERFORMING OTHER VITAL FUNCTIONS.

THE FOLLOWING LOCATIONS ARE NOT TO BE USED FOR MOUNTING TUBING CLIPS OR ANY OTHER COMPONENT WITHOUT SPECIFIC APPROVAL FROM ENGINEERING.

A. LOWER PLATE OF STEERING GEAR HOUSING.
B. SIDE PLATE OF STEERING GEAR HOUSING BELOW THE LUBRICANT LEVEL.
C. TOP OR BOTTOM PLATES ON THE RADIATOR.
D. COMPRESSOR HEAD BOLTS.

6. EXTENSION OF BOLT THROUGH NUT

A MINIMUM OF 1 1/2 THREADS AND A MAXIMUM OF 5/8 INCH (15MM) OF THREADED BOLT SHOULD EXTEND THROUGH A NUT WHEN IT HAS BEEN PROPERLY TIGHTENED. THIS PERTAINS TO BOLTS 4 INCHES (100MM) IN LENGTH AND SHORTER.

FOR BOLTS OVER 4 INCHES (100MM) IN LENGTH, A MINIMUM OF 1 1/2 THREADS AND A MAXIMUM OF 3/4 INCH (19MM) OF THREADED BOLT IS ALLOWABLE.

ANY DEVIATION MUST BE INDIVIDUALLY APPROVED BY ENGINEERING.

7. LOCKWASHER - FLATWASHER COMBINATION

A FLATWASHER TOGETHER WITH A LOCKWASHER AS A PAIR TEND TO DEFEAT EACH OTHER'S PURPOSE AND WILL NOT BE USED.

CHG	JOB/RLSE NO	DATE	BY	REVISION
F	PA2024-55	12/20/90	ERK	REVISED AND REDRAWN

ORIGINAL

8. STUDS

STUDS ARE LOCKED INTO THE BASE STRUCTURE WITH INTERFERENCE FIT THREADS, SHOULDERING, OR BY SOME AUXILIARY LOCKING DEVICE SUCH AS THREAD LOCK COMPOUND (LOCTITE) 48-00094-131. STUDS MAY BE USED AS RECEIVED (SLIGHTLY OILED).

9. NUTS ON STUDS

FREE SPINNING NUTS ARE TO BE USED TO RETAIN COMPONENTS MOUNTED ON STUDS AND LOCKED BY HELICAL SPRING LOCK WASHERS (SPLIT WASHERS) OR INTERNAL TOOTH LOCK WASHERS. LOCK NUTS ARE TO BE AVOIDED BECAUSE THEY TEND TO LOOSEN THE STUDS ON REMOVAL. DO NOT USE PLAIN WASHERS.

10. LOCK WASHERS

LOCK WASHERS (SPLIT OR TOOTHED) ARE NOT TO BE USED NEXT TO ALUMINUM SURFACES. (EXCEPT WHEN USED TO PROVIDE A GOOD ELECTRICAL GROUND)

11. TAPPING SCREWS

TYPE

TYPE AB TAPPING SCREWS ARE PREFERRED FOR USE.

AB

TYPE B TAPPING SCREWS ARE TO BE USED WHEN A BLUNT END IS REQUIRED.

B

12. STARTING THREADS

FASTENERS MUST BE STARTED BY HAND IN ALUMINUM OR IN PLASTIC PARTS WITH THREADED HOLES TO ENSURE STRAIGHT STARTING AND TO PREVENT DAMAGED THREADS. TORQUE IN ACCORDANCE WITH ENGINEERING DRAWING SPECIFICATION.

13. FASTENING CHROME PLATED ALUMINUM PARTS

WHEN FASTENING CHROME PLATED ALUMINUM PARTS, CARE MUST BE TAKEN NOT TO TORQUE THE FASTENERS TO SUCH AN EXTENT THAT DAMAGE TO THE PLATING RESULTS.

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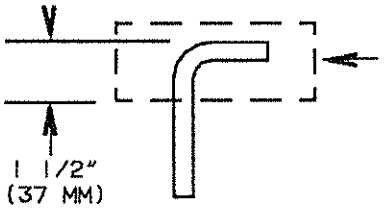
F	PA2024-55	12/20/90	ERK	REVISED AND REDRAWN

ORIGINAL

14. WELD STUDS

WELD STUDS MAY BE APPLIED TO THE WEB PORTION OF STEEL FRAME RAILS OR LINERS FOR WIRING OR TUBING CLIP ATTACHMENT IN LIEU OF DRILLING FOR BOLTS, PROVIDING THAT NO STUD IS LOCATED IN THE FLANGE RADIUS, ON THE FLANGE SURFACE OR ON THE EDGE OF THE FLANGE AND A 1 1/2" (37MM) EDGE DIMENSION IS MAINTAINED.



NO WELD STUDS IN THIS AREA OF TOP AND BOTTOM FLANGES.

IN ADDITION, WELD STUDS ARE NOT TO BE APPLIED TO FRAME MOUNTED COMPONENTS SUCH AS STEERING GEARS AND LINKAGE, ENGINES, SUSPENSION PARTS, ETC.

SELF LOCKING NUTS ARE TO BE USED ON WELD STUDS.

DO NOT WELD WITHOUT REMOVING ALL ELECTRONIC COMPONENTS FROM THE ELECTRICAL SYSTEM.

15. HIGH STRENGTH LOCKING COMPOUND FOR FASTENERS (Ø1"(25MM) AND LARGER)

1. CLEAN MALE AND FEMALE THREADS OF FASTENER FREE OF ALL DIRT, OIL, OR OTHER FOREIGN MATERIAL. IF PARTS ARE CONTAMINATED, USE STODDARD SOLVENT FOR CLEANING. LET AIR DRY FOR TEN MINUTES. BE SURE SOLVENT IS COMPLETELY GONE BEFORE ADHESIVE IS APPLIED.

2. APPLICATION

   LOCKING COMPOUND MUST BE DISPENSED FROM THE CONTAINER TO A SMALL DISH OR PAPER CUP. APPLY COMPOUND TO THREADS WITH PLASTIC BRUSH (METAL BRUSH WILL CONTAMINATE COMPOUND) TO ENTIRE CIRCUMFERENCE OF THREE TO FOUR THREADS THAT WILL BE COVERED BY NUT AT FINAL POSITION. BE SURE ENOUGH COMPOUND IS APPLIED TO FILL INSIDE OF NUT THREADS WITH A SLIGHT EXCESS.

   READJUSTMENT OF NUT POSITION IS NOT POSSIBLE AFTER ASSEMBLY IS COMPLETED.

3. SAFETY PRECAUTIONS

   NORMAL PRECAUTIONS SHOULD BE TAKEN TO FOLLOW DETAILED INSTRUCTIONS ON LOCKING COMPOUND CONTAINER.

4. DISASSEMBLY OF BONDED FASTENER MUST BE DONE WHILE HOT. BOND LINE SHOULD BE HEATED TO 204°C (400°F) TO BE ABLE TO REMOVE FASTENER WITH REDUCED TORQUE.

   CAUTION:
   IF ANY COMPONENTS ARE DAMAGED BY OVERHEATING, THEY MUST BE REPLACED.
   DO NOT REUSE FASTENERS.

5. APPROVED SOLVENT AND LOCKING COMPOUND

   SHOP SOLVENT - STODDARD SOLVENT
   LOCKING COMPOUND - 48-00094-121 (LOCTITE 277)

CHG	JOB/RLSE NO	DATE	BY	REVISION
F	PA2024-55	12/20/90	ERK	REVISED AND REDRAWN

ORIGINAL

DRAWN	ERK	TITLE	ITEM NUMBER
APPRV	ANF	SHOP PRACTICE FASTENERS	33-00109
DATE	06/07/85	FREIGHTLINER CORPORATION PORTLAND, OREGON	SHEET 8 OF 12

16. SOLID RIVET HOLE SIZE SELECTION

THE FOLLOWING HOLE SIZES ARE RECOMMENDED FOR THE BEST STRENGTH OF A BUCKED RIVETED JOINT.

NOMINAL RIVET DIA. (INCHES)	1/8	5/32	3/16	1/4	5/16	3/8	7/16
HOLE DIAMETER (INCHES)	.129	.159	.194	.257	.323	.391	.453
CORRESPONDING DRILL SIZE	30	21	10	F	P	25/64	29/64

17. BOLT TORQUE

IN ATTAINING SPECIFIED TORQUE VALUES, THE READING SHOULD BE TAKEN FROM THE NUT END OF THE ASSEMBLY; I.E., THE TIGHTENING PROCESS WHILE THE NUT IS TURNED.

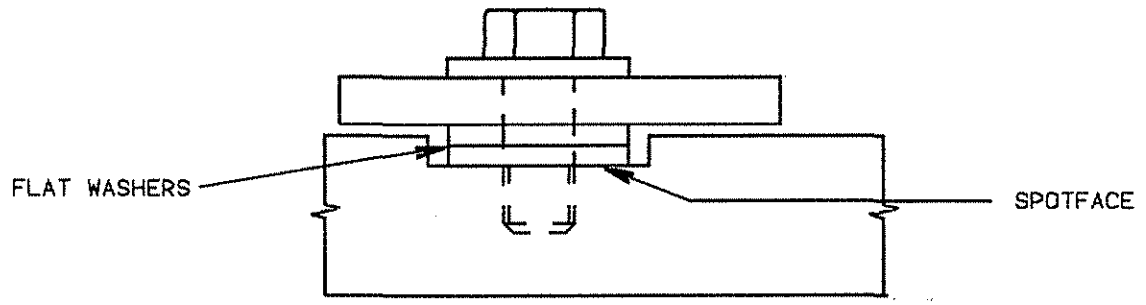
PARTS SHALL BE IN CONTACT (WITH NO GAP) BEFORE FINAL TORQUE APPLICATION.

18. COUNTERSUNK BOLTS

IN THE ABSENCE OF SPECIFIC TORQUING INFORMATION, TORQUE VALUES FOR CORRESPONDING SIZE AND GRADE OF REGULAR CAP SCREWS ARE APPROPRIATE.

19. SPOTFACE AREAS

WHEN MOUNTING BRACKETS, BRACES, AND OTHER PARTS AT RECESSED SPOTFACED HOLES, BE SURE TO FILL ANY POSSIBLE GAPS WITH SUFFICIENT FLAT WASHERS TO PREVENT INTERFERENCE AT POINTS OUTSIDE THE SPOTFACED AREA. (SEE SKETCH)



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ORIGINAL

DRAWN	ERK	TITLE	ITEM NUMBER
APPRV	ANF	SHOP PRACTICE FASTENERS	33-00109
DATE	06/07/85	FREIGHTLINER CORPORATION PORTLAND, OREGON	SHEET 9 OF 12

20. INCH FASTENER: ZINC PLATED CAPSCREW W/ZINC PLATED WASHERS AND CADMIUM PLATED AND WAX COATED LOCKNUTS

BOLT SIZE	GRADE 5							
	TORQUE (FT/LB)				TORQUE (N.M)			
	LOAD (LB)*	MIN	TARGET	MAX	LOAD (N)*	MIN	TARGET	MAX
1/4-20	2,298	6	7	8	10,227	9	10	11
1/4-28	2,630	7	8	9	11,705	10	11	12
5/16-18	3,786	13	15	17	16,849	18	20	22
5/16-24	4,191	14	16	18	18,652	20	22	25
3/8-16	5,600	23	26	29	24,922	31	36	40
3/8-24	6,344	26	30	33	28,233	36	40	45
7/16-14	7,680	37	42	47	34,179	50	57	64
7/16-20	8,576	41	47	53	38,167	56	64	71
1/2-13	10,252	57	64	72	45,625	77	87	98
1/2-20	11,553	64	72	81	51,415	86	98	109
9/16-12	13,150	82	92	103	58,523	111	125	140
9/16-18	14,667	91	103	115	65,274	123	138	156
5/8-11	16,329	113	128	143	72,670	153	173	193
5/8-18	18,496	128	145	162	82,314	173	196	219
3/4-10	24,131	200	226	253	107,392	271	307	343
3/4-16	26,949	223	253	282	119,933	302	343	383
7/8- 9	33,380	322	365	408	148,554	437	496	553
7/8-14	36,775	355	402	450	163,663	481	545	609

PHOSPHATE AND OIL CAPSCREWS W/ ZINC PLATED HARDENED WASHERS AND CADMIUM PLATED AND WAX COATED LOCKNUTS

BOLT SIZE	GRADE 8 & 8.2							
	TORQUE (FT/LB)				TORQUE (N.M)			
	LOAD (LB)*	MIN	TARGET	MAX	LOAD (N)*	MIN	TARGET	MAX
1/4-20	3,244	7	8	9	14,430	10	11	12
1/4-28	3,713	8	9	10	16,516	11	12	13
5/16-18	5,345	14	16	18	23,775	19	22	25
5/16-24	5,916	15	17	20	26,315	21	24	27
3/8-16	7,905	25	28	31	35,163	34	38	42
3/8-24	8,956	28	32	35	39,838	38	43	48
7/16-14	10,843	40	45	50	48,232	54	61	68
7/16-20	12,107	44	50	56	53,854	60	68	76
1/2-13	14,474	60	68	76	64,383	81	92	103
1/2-20	16,310	68	77	86	72,550	92	104	117
9/16-12	18,564	86	98	109	82,576	117	133	148
9/16-18	20,706	97	110	123	92,104	132	149	167
5/8-11	23,052	120	136	152	102,540	163	184	206
5/8-18	26,112	134	154	172	116,151	182	209	233
3/4-10	34,068	213	241	269	151,542	289	327	365
3/4-16	38,046	237	269	301	169,237	321	365	408
7/8- 9	47,124	342	388	434	209,618	464	526	588
7/8-14	51,918	377	427	477	230,942	511	579	647
1 - 8	61,812	514	582	650	274,953	696	789	881
1 -12	67,626	562	637	712	300,815	761	863	965
1 -14	69,258	575	652	729	308,074	779	883	988

* CLAMP LOAD @ TARGET TORQUE

CHG	JOB/RLSE NO	DATE	BY	REVISION
F	PA2024-55	12/19/90	ERK	REVISED AND REDRAWN

ORIGINAL

DRAWN	ERK	TITLE	ITEM NUMBER
APPRV	ANF	SHOP PRACTICE FASTENERS	33-00109
DATE	06/07/85	FREIGHTLINER CORPORATION PORTLAND, OREGON	SHEET 10 OF 12

21. INCH FASTENER: FLANGE HEAD, PLATED OR LUBRICATED THREAD

BOLT SIZE	GRADE 5							
	TORQUE (FT/LB)				TORQUE (N.M)			
	LOAD (LB)*	MIN	TARGET	MAX	LOAD (N)*	MIN	TARGET	MAX
1/4-20	2,025	5	6	7	9,007	7	8	9
1/4-28	2,325	5	7	9	10,342	7	9	12
5/16-18	3,340	10	13	16	14,856	14	18	22
5/16-24	3,675	11	14	17	16,346	15	19	23
3/8-16	4,950	18	23	28	22,018	24	31	38
3/8-24	5,590	20	25	30	24,864	27	34	41
7/16-14	6,790	25	35	45	30,202	34	47	61
7/16-20	7,575	30	40	50	33,694	41	54	68
1/2-13	9,075	45	55	65	40,366	61	75	88
1/2-20	10,200	50	65	80	45,370	68	88	108
9/16-12	11,625	65	80	95	51,708	88	108	129
9/16-18	12,975	70	90	110	57,713	95	122	149
5/8-11	14,400	90	110	130	64,051	122	149	176
5/8-18	16,350	105	130	155	72,725	142	176	210
3/4-10	21,300	160	200	240	94,742	217	271	325
3/4-16	23,775	180	220	260	105,751	244	298	353
7/8- 9	29,475	260	320	380	131,105	353	434	515
7/8-14	32,475	280	350	420	144,449	380	475	569

BOLT SIZE	GRADE 8 & 8.2							
	TORQUE (FT/LB)				TORQUE (N.M)			
	LOAD (LB)*	MIN	TARGET	MAX	LOAD (N)*	MIN	TARGET	MAX
1/4-20	3,230	9	10	11	14,367	12	14	15
1/4-28	3,700	11	12	13	16,458	14	16	18
5/16-18	5,360	19	21	24	23,841	25	28	32
5/16-24	5,900	20	23	26	26,243	28	31	35
3/8-16	7,900	33	37	41	35,139	45	50	56
3/8-24	8,900	37	42	47	39,587	50	57	64
7/16-14	10,900	53	60	67	48,483	72	81	91
7/16-20	12,000	58	66	74	53,376	79	89	100
1/2-13	14,500	80	91	102	64,496	108	123	138
1/2-20	16,300	90	102	114	72,502	122	138	155
9/16-12	18,500	115	130	145	82,288	156	176	197
9/16-18	20,700	129	146	163	92,074	175	198	221
5/8-11	23,000	159	180	201	102,304	216	244	273
5/8-18	26,100	180	204	228	116,093	244	277	309
3/4-10	34,100	282	320	358	151,677	382	434	485
3/4-16	38,100	315	357	399	169,469	427	484	541
7/8- 9	47,100	454	515	575	209,501	616	698	780
7/8-14	51,900	501	568	635	230,851	679	770	861

* CLAMP LOAD @ TARGET TORQUE

CHG	JOB/RLSE NO	DATE	BY	REVISION
F	PA2024-55	12/20/90	ERK	REVISED AND REDRAWN

ORIGINAL

DRAWN	ERK	TITLE	ITEM NUMBER
APPRV	ANF	SHOP PRACTICE FASTENERS	33-00109
DATE	06/07/85	FREIGHTLINER CORPORATION PORTLAND, OREGON	SHEET 11 OF 12

22. METRIC FASTENER: PHOSPHATE AND OIL CAPSCREWS W/ZINC PLATED WASHERS AND CADMIUM PLATED AND WAX COATED LOCKNUTS

BOLT SIZE	CLASS 8.8							
	LOAD *	TORQUE (FT/LBS)			LOAD *	TORQUE (N.M)		
	LBS	MIN	TARGET	MAX	NEWTONS	MIN	TARGET	MAX
M6	2,227	4	5	6	9,909	6	7	8
M8	4,055	11	12	13	18,044	14	16	18
M8X1	4,343	12	13	14	19,326	16	18	20
M10	6,425	21	24	27	28,594	29	32	36
M10X1.25	7,145	23	27	30	31,799	32	36	40
M12	9,339	37	42	47	41,560	50	56	63
M12X1.5	9,759	38	43	51	43,433	52	59	66
M14	12,739	58	66	74	56,695	79	90	100
M14X1.5	13,847	64	72	80	61,625	86	98	109
M16	17,392	91	103	115	77,401	124	140	156
M16X1.5	18,500	97	110	123	82,331	131	149	166
M18	21,861	130	147	164	97,920	176	199	223
M18X1.5	24,753	146	165	185	110,160	198	224	250
M20	28,076	184	208	233	124,950	249	282	316
M20X1.5	31,170	204	231	259	138,720	277	314	350
M22	34,723	250	283	317	154,530	339	384	429
M22X1.5	38,161	275	315	348	169,830	373	422	472
M24	40,453	318	360	403	180,030	431	488	546
M24X2	44,005	346	392	438	195,840	469	531	594
M27	52,600	465	527	589	234,090	630	714	798
M27X2	56,840	503	569	636	252,960	681	772	863
M30	64,289	631	715	799	286,110	856	970	1,084
M30X2	71,165	699	792	885	316,710	947	1,074	1,200

* CLAMP LOAD @ TARGET TORQUE

CHG	JOB/RLSE NO	DATE	BY	REVISION
F	PA2024-55	12/20/90	ERK	REVISED AND REDRAWN

ORIGINAL

DRAWN	ERK	TITLE	ITEM NUMBER
APPRV	ANF	SHOP PRACTICE FASTENERS	33-00109
DATE	06/07/85	FREIGHTLINER CORPORATION PORTLAND, OREGON	SHEET 12 OF 12

22. METRIC FASTENER: PHOSPHATE AND OIL CAPSCREWS W/ZINC PLATED HARDENED WASHERS AND CADMIUM PLATED, WAX COATED LOCKNUTS (CONT.)

BOLT SIZE	CLASS 10.9							
	LOAD *	TORQUE (FT/LBS)			LOAD *	TORQUE (N.M)		
	LBS	MIN	TARGET	MAX	NEWTONS	MIN	TARGET	MAX
M6	3,186	6	7	8	14,181	9	10	11
M8	5,802	15	17	19	25,821	21	23	26
M8X1	6,214	16	18	21	27,656	22	25	28
M10	9,195	30	34	38	40,919	41	46	52
M10X1.25	10,225	33	38	42	45,505	45	51	58
M12	13,364	53	60	67	59,474	72	81	90
M12X1.5	13,966	55	62	70	62,155	74	84	94
M14	18,231	84	95	106	81,133	113	128	143
M14X1.5	19,816	91	103	115	88,188	123	140	156
M16	24,889	130	148	165	110,764	177	200	224
M16X1.5	26,474	139	157	176	117,819	188	213	238
M18	30,437	179	203	227	135,456	243	276	308
M18X1.5	34,242	202	229	256	152,388	273	310	346
M20	38,839	255	288	322	172,848	346	391	437
M20X1.5	43,119	282	320	358	191,896	383	434	485
M22	48,033	346	392	438	213,767	469	531	594
M22X1.5	52,789	380	431	482	234,932	515	584	653
M24	55,960	440	498	557	249,042	596	675	755
M24X2	60,874	478	542	606	270,912	648	735	821
M27	72,764	643	729	815	323,825	872	988	1104
M27X2	78,629	695	788	880	349,928	942	1,068	1,193
M30	88,933	873	990	1,106	395,786	1,184	1,342	1,500
M30X2	98,445	967	1,096	1,224	438,116	1,311	1,485	1,660

* CLAMP LOAD @ TARGET TORQUE

CHG	JOB/RLSE NO	DATE	BY	REVISION
F	PA2024-55	12/20/90	ERK	REVISED AND REDRAWN

ORIGINAL

COMPILED	HJR	SHOP PRACTICE TENSIONS SPRINGS	SECTION NUMBER 33-00110
APPRV	VHS		
ISSUE DATE	05/11/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	B		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0000-003 FOR TENSION SPRINGS.

Compiled	H.J.R.	SHOP PRACTICE TENSION OR PULL-BACK SPRINGS	33-00110
Approved	V.H.S.		
Issued	5-11-65		
Revised	4-4-80	Chg Ltr A **FREIGHTLINER CORPORATION** PORTLAND, OREGON	

Pull-back spring installations are usally very simple and easy, but a few quite critical fundamentals must be observed if they are to be long-lived and troublefree:

1. The spring at installation must be free of nicks and other damage, especially at the anchor loops. Especial care must be taken not to inflict such damage with any installation tool used. (For example, use a hook instead of sharply serrated pliers or vice-grips to pull into place.)

2. Provide smooth, round means of anchorage if possible. If not possible, be sure that the sharp-edge support is not as hard or harder than the spring and, on the other hand, that its hardness and size or edge distance are sufficient that rapid failure due to wear of the support will not result.

3. Position anchorages so that in all possible operating positions, the spring ends are not forced into a bind, but are free to accommodate to the motion.

4. Position anchorages so as to minimize unwanted rubbing of the coils against other parts, both to protect the spring and the part rubbed.

5. Avoid stretching the spring so much it won't return to its original length when released. Doing so will impair its ability to perform the job for which it was designed.

RETYPED 7-29-77

COMPILED	V D	SHOP PRACTICE ADHESIVE APPLICATION STUDS AND FASTENERS	SECTION NUMBER 33-00111
APPRV	DCR		
ISSUE DATE	02/15/82		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0000-004 FOR ADHESIVE APPLICATION STUDS AND FASTENERS.

Compiled	V. DORSEY	SHOP PRACTICE ADHESIVE APPLICATION STUDS AND FASTENERS	33-00111
Approved	DCR		
Issued	2-15-82		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

1. TYPE SELECTION BY FASTENER DIAMETER

   A. 1.00" and smaller - Loctite #271

   B. Over 1.00" - Loctite #277

2. PRECAUTIONS

   Note and follow the detailed instructions furnished with the adhesive.

3. PRIMER

   Loctite Loquil Primer "T" #747

4. SOLVENT

   Loctite #755

5. APPLICATION PROCEDURE

   (Steps C, D, & F apply only if priming is used or specified.)

   A. Threads must be clean and free of dirt, oil, and other foreign material.

   B. If contaminated, clean with an approved safety solvent or Stoddard solvent. Wipe off the excess with a clean cloth.

   C. Prime the mating areas with primer or activator.

   D. Let dry one to ten minutes.

   E. Apply adhesive for the entire circumference of 2 or 3 threads. Ensure that the thread valleys are filled and that the adhesive filled are engaged after assembly.

   F. Assembly must be completed within 5 minutes of application. If not, repeat the above steps.

6. DISASSEMBLY OR READJUSTMENT of a bonded fastener is possible by heating the bond line to 400°F and loosen the fastener with reduced torque. Parts damaged by over heating must be discarded.

7. REUSE OF FASTENERS is permissable by brushing off old material from both male and female threads and repeating the above steps.

Compiled	B.SMITH	SHOP PRACTICE LABEL AND DECAL APPLICATION	33-00112
Approved	PHILLPS		
Issued	9-24-76		
Revised	4-4-80	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	

LABEL AND DECAL APPLICATION

The following rules should be observed to assure proper bonding of labels and decals.

a. Make certain the surface to which the label or decal is to be attached is free from contaiminates such as grease, oil and dirt. The surface can be cleaned with primer reducer or similar thinner if the surface is UNPAINTED METAL. Alcohol can be used for other surfaces if required. The surface must also be dry.

b. The temperature should be 65°F or above for good bonding of labels and decals. If temperature drops below 65°F the adhesive of the label or decal can be sprayed with Acta. (Manufactured by Gem Nameplate of Seattle Wash. and purchased from Masterscreen Portland OR) This should only be done when absolutely necessary and temperatures should not be below 50°F.

COMPILED	FF	SHOP PRACTICE PAINTING AND PRIMING	SECTION NUMBER 33-00113
APPRV	JAKE		
ISSUE DATE	06/11/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0000-005 FOR PAINTING AND PRIMING.

A. AREAS/ITEMS NOT TO BE PAINTED

The following items are to be masked adequately for protection against indirect and direct paint spray. If painting is specifically required, it will be noted on the chassis specification sheet and/or the paint chart.

00 GROUP

1. Chromed, polished or anodized surfaces
2. Protective boots
3. Plastic parts
4. Instruction decals and labels

03 GROUP - AIR INTAKE & FUEL

1. Rubber air intake elbows and hoses
2. Fuel tank - check paint chart when painted per customer request
3. Band to band fuel tank steps (Ref: 33-03105)
4. Fuel tank cap and filler neck threads.

05 GROUP - COOLING

1. Contacting edges of shtter vanes
2. Finned fan hubs

06 GROUP - ELECTRICAL

1. Battery box cover - check paint chart when painted per customer request.

07 GROUP - TRANSMISSION

1. Sliding shafts in shift box and dome(s)
2. Back-up lamp switch terminals
3. Oil seal at driveline yoke

10 & 11 GROUPS - AXLES

1. Wheel mounting surface of the hub
2. Exposed wheel stud threads
3. Disc brake pins - See 10 & 11 GROUP

A. AREAS NOT TO BE PAINTED (CONT.)

12 GROUP - BRAKE CONTROLS

1. Finned air tanks.
2. Brakeline filters or air dryers.
3. Safety Valve.

13 GROUP - WHEELS

1. Spoke wheel rim mounting surfaces.
2. Spoke wheel rims and spacers - check the paint chart.

14 GROUP - STEERING

1. Steering column slip shaft.

16 GROUP - SUSPENSION

1. Rubber portion of FAS air bags.

18 & 22 GROUPS - CAB & ACCESSORIES

1. Glass, including instrument windows.
2. Weatherstripping.
3. COE under door step tread and grip strip.
4. Window sill, door lock button and window stop blocks.

   NOTE: These parts are not to be solvent or etch washed nor are they to go through the dry oven.

5. Cab ladder step.
6. Door check arms.

   NOTE: These parts are to be installed after paint in the as-received black primer finish. Temporary 180 degree check arms may be installed in all the pre-paint cabs to prevent paint scratches due to unchecked door swing.

7. Convex mirrors - These will be stainless or (vendor painted) black.
8. ALUMINUM QUARTER FENDERS either polished or unpolished. All chromed and stainless steel.
9. License plate brackets mounted under unpainted or bright bumpers.
10. Oil check door spring.
11. Exterior grabhandles in COE frontal air opening.

B. AREAS/ITEMS TO BE PAINTED

1. Steel piece parts, excepting those that require welding to complete assembly, are to be primed per 49-00023 or zinc plated with supplementary chromate or phosphate treatment (49-5-201 or 49-5-301) before shipment or storage.

2. OEM Engine parts that are modified by welding, drilling, etc. are to be re-painted the appropriate engine color.

ENGINE	COLOR	PAINT NUMBER
CUMMINS	BEIGE	DUP/93-57726 SWP/G74HC20
CATERPILLAR	HIGHWAY YELLOW	DUP/1081-43113 DUP/93-421
DDE	ALPINE GREEN	DUP/93-73978 SW/Q21G070
	ALUM. PRIME. METALLIC GRAY GOLD	DDE/5149633 DDE/5149634 DDE/5149635
	SILVER	DDE/5149996

3. GRILLE BACKGROUND

The unpainted parts that are visible through the grille, are to be painted flat black, such parts are typically:

A. A/C condensor mounting brackets.
B. Wind baffle attachment strips.
C. Radiator side channel (front edge only).

4. HEAT RESISTANT ALUMINUM PAINT

The following brands of heat resistant paints are approved:

MANUFACTURER	NUMBER	TEMPERATURE °F	
RUSTOLEUM	RST/4115	400-500	* Must be clean metal & baked @ 450°F for 45 min.
	RST/4215	800	
	RST/4315	1200 *	
DUPONT		800	

C. FIBERGLASS HOODS - The following areas only under the hood are to be painted the major body color:

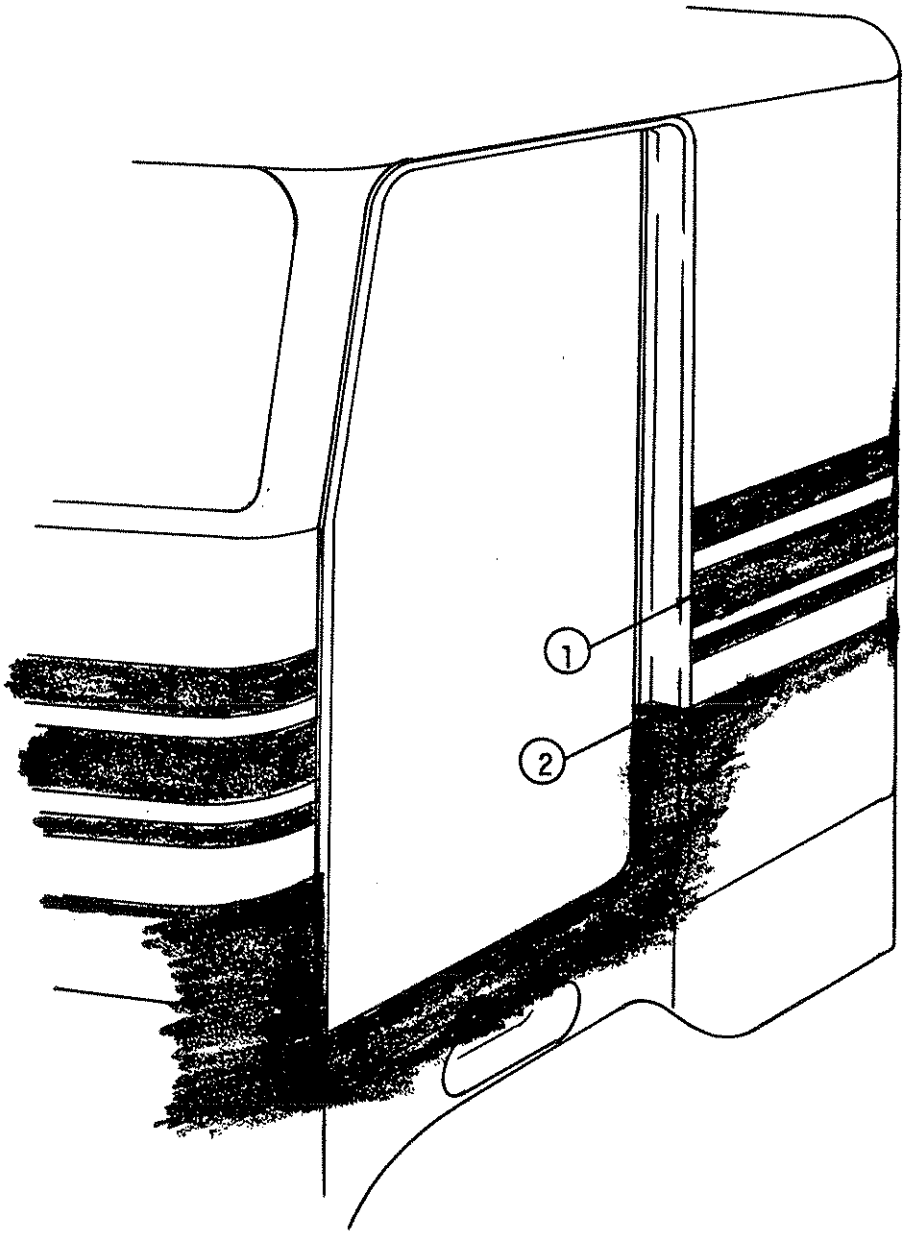
1. Front of hood, back 5".
2. Rear of hood, forward 4.5".
3. Wheel wells including the outboard side of the wheel well skirts.

D. STRIPES & PAINT BREAKS

Unless specified otherwise on the paint chart, the door jambs and frames are to be painted as follows:

1. All stripes 8" and less will terminate against the door frame as shown. The door frame or jamb will be painted the field (majority) color.

2. All color breaks and stripes over 8" will carry thru the frame or jamb as shown.



E. CAB SIDE EXTENDERS

Unless specified otherwise on the paint chart, the extenders are to be painted to match the cab with the following qualifications:

1. Cab paint designs with horizontal or diagonal lines leading to the cab side extenders will be continued to the extenders.

2. Cab paint designs which normally continue on to the back of the cab will not extend on to the back of the cab with cab side extenders.

F. HOOD TO COWL PAINT STRIPE ALIGNMENT

1. All stripes that extend from the hood onto the cab will not exceed 1/4" maximum total vertical misalignment.

COMPILED	ERK
APPRV	ANF
ISSUE DATE	10/23/65
REV DATE	07/29/96
CHG LTR	M

SHOP PRACTICE

ANTI-CORROSION COMPOUNDS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-00115

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0000-006 FOR ANTI-CORROSION COMPOUND.

COMPILED	ERK	SHOP PRACTICE ANTI-CORROSION COMPOUNDS	SECTION NUMBER 33-00115
APPRV	ANF		PAGE 1 OF 1
ISSUE DATE	10/23/65	FREIGHTLINER CORPORATION PORTLAND, OREGON	P8332G-01
REV DATE	12/17/90		
CHG LTR	L		

DISSIMILAR METALS:

WHENEVER PARTS CONSISTING OF DIFFERENT METALS ARE FASTENED TOGETHER, AND THERE IS ANY POSSIBILITY OF MOISTURE GETTING BETWEEN THEM, A CONDITION OF POSSIBLY SEVERE ELECTROLYTIC CORROSION EXISTS. IN ORDER TO PREVENT THIS AS MUCH AS POSSIBLE, AN INSULATING COMPOUND IS APPLIED TO THE CONTACT AREA BETWEEN THE PIECES. THE AREA MUST BE THOROUGHLY COATED, SO THAT NO POSSIBLE POCKETS OF MOISTURE MAY BE FORMED.

THE FOLLOWING IS A LIST OF TYPICAL PLACES IN WHICH AN ANTI-CORROSION COMPOUND SHOULD BE USED:

- BETWEEN ALL CASTINGS, WHETHER ALUMINUM, MAGNESIUM, OR STEEL, AND THE FRAME RAIL.
- L BENEATH ALL STEEL PARTS FASTENED TO THE CAB EXTERIOR PRIOR TO PAINT (EXTERIOR DEFINED AS ANY LOCATION OUTSIDE OF THE CAB DOOR WEATHER SEAL). THIS WOULD APPLY TO ALL STEEL PARTS WHETHER STAINLESS OR PLATED.
- BETWEEN THE STEEL BACK OF CAB REINFORCEMENT AND THE BACK SKIN.
- BETWEEN UPPER EXHAUST BRACKET AND CAB SKIN.
- BETWEEN THE ROUGH-SERVICE STEEL CAB ANGLE REINFORCEMENT TO THE DECK, AND THE STEEL HAT-SECTION REINFORCING THE BACK OF THE CAB.
- BETWEEN DOOR HINGE/POST AND BETWEEN DOOR HINGE/DOOR POST.
- BETWEEN THE SHIFTER BRACKET AND THE TUNNEL SIDE.
- BETWEEN THE DOUBLER PLATE AND THE TUNNEL SIDE.
- BETWEEN THE FRAME INSERT AND THE FRAME RAIL.

DO NOT USE AS A WEATHER SEAL FOR A RIVETED SEAM IN THE SAME METAL, AS FOR EXAMPLE, AT THE CAB OUTER ROOF BOW, OR CAB INTERIOR.

DO NOT USE ON MATING FLANGES, SUCH AS BETWEEN ENGINE FLYWHEEL HOUSING AND TRANSMISSION BELL HOUSING.

ACCEPTABLE COMPOUNDS:

TRUCK PLANTS:

MT HOLLY 48-00094-530 OR 48-00094-531.
PORTLAND & BURNABY 48-00119-000 OR 48-00094-520

PARTS PLANTS:

48-00094-520

WARNING - PUR...
...UGON ID=04723

RELIEF CUT-OUTS IN STRESSED PARTS

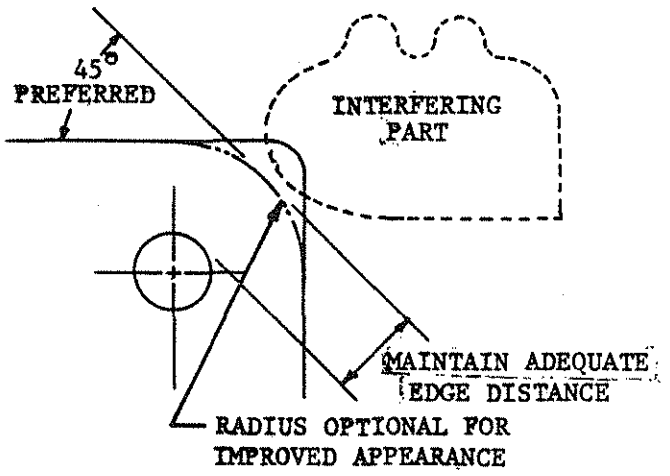
A modified stock part can often get around the need for a specially designed one, but the resulting structure must be carefully checked to be sure it is adequate for the intended use. In general, any such modification must be referred to Engineering for review.

Some possible modifications that can be used, with Engineering approval, are as follows:

1. Bevel (or Round)

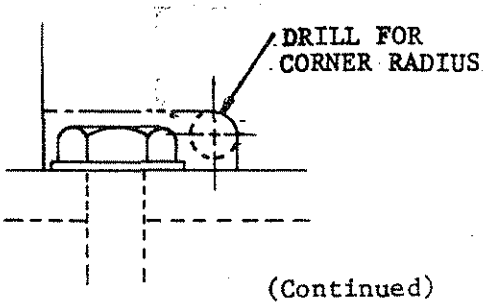
A corner can frequently be beveled or rounded off to provide a needed clearance. (See Figure). When a bevel cut is used, a 45° cut-off angle is preferred.

When a convex radius is used, it should be shaped for pleasing appearance as well as adequate (but not excessive) clearance. Special care should be taken that no notches or undercuts impair either the structural strength or appearance.



2. Re-entrant cuts

Avoid re-entrant cuts when possible, but when necessary, use a suitably large radius at the inner corner. Good practice is to drill a generous size hole and then cut carefully tangent to its sides. Leave no rough nor abruptly offset surfaces and break all sharp edges.



(Continued)

RETYPED "A" CHG 7-29-77

A

A

RELIEF CUT-OUTS IN STRESSED PARTS (Continued)

2. Grinding, if done, should always have the microscopic scratches run parallel to the stresses and not crosswise to them.

3. Clearance and access holes

B

When a hole must be made in a part for clearance or access, it is preferable that it be a through hole (not a blind hole), and that it be large enough to provide easy clearance without imposing tight tolerances of location or adjustment for assembly. Although it usually affects structure less than an external cut, a hole must be considered for its effect on needed structural strength and stiffness. Break all sharp edges.

RETYPED "A" CHG 7-29-77

Compiled	F. Freer	SHOP PRACTICE SHIP LOOSE PARTS ON GLIDERS	33-00120
Approved	JAKE		
Issued	4-5-76		
Revised	4-4-86	Chg Ltr C	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

All parts supplied with gliders that are not securely fastened in the normal manner are to be shipped as follows:

1. A PARTS BOX is to be banded on top of the frame behind the cab. All loose parts that fit inside the box are to be placed therein.

2. AIR CLEANERS are to be sealed against water. On 'Engine Mounted' cleaner installations, the cleaner is to be banded to a wooden frame and then to the frame under the cab tunnel.

3. SNORKEL TUBES are to be sealed at both ends and wrapped in cardboard and secured in the sleeper bunk with the bunk straps. If the cab is a non-sleeper, the tube is to be banded onto the top of the parts box.

4. BATTERY BOX COVER is to be installed and banded to the battery box frame or placed in the parts box.

REVISED & RETYPED 'C' CHANGE

Compiled	MacDonald	SHOP PRACTICE DEBURRING & EDGE BREAKING	33-00121
Approved	MacDonald		
Issued	11-8-76		
Revised	11-6-87	Chg Ltr G FREIGHTLINER CORPORATION PORTLAND, OREGON	

1. All burrs in excess of .003" (.08mm) nominal thickness shal- not exceed .010" (.25mm) high. Burrs and the edges of burrs less than .003" (.08mm) thick generally will not affect function or handling safety and should therefore be ignored.

2. Engineering drawings may stipulate areas of burr removal and must be adhered to.

3. Engineering drawings may also specify burr heights in excess of this standard as requirements allow.

4. Burrs shall not be included within the dimensional specifications of features on engineering drawings (when measuring a part, measure to the base feature, not the top of a burr).

COMPILED	E M	SHOP PRACTICE FORMING IMPERFECTIONS	SECTION NUMBER 33-00122
APPRV	B M		
ISSUE DATE	03/25/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0000-007 FOR FORMING IMPERFECTIONS.

Compiled	E.MACDONALD	SHOP PRACTICE	
Approved	B. MOOERS	FORMING IMPERFECTIONS	33-00122
Issued	3-25-85		
Revised	5-1-86	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	

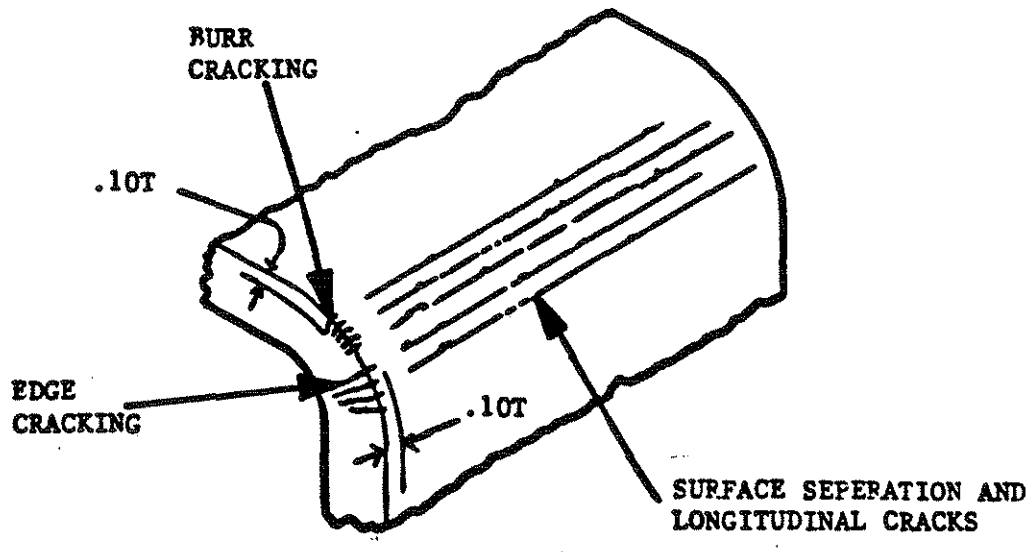
When ferrous and aluminum parts are formed, certain imperfections may occur. The purpose of this shop practice page is to define the most common imperfections and note their acceptability/rejection.

1) Burr Cracking: This is the corner cracking that occurs on the outside of the material at the edge of the part, often a burr results from shearing. A burr crack of less than 10% of the nominal material thickness in either direction shall be acceptable. To help control this condition, edges may be chamfered up to .25T in bend area. Chamfer must not end abruptly.

2) Edge Cracking: Edge cracks are the superficial cracks which run radially across the edge of part. An edge crack of less than 10% of the material thickness in depth shall be acceptable. To help control this condition, edges may be chamfered up to .25T in bend area. Chamfer must not end abruptly.

3) Surface Separation: Surface separation appears as longitudinal lines along the outside bend surface. These are superficial only and do not show up as cracks with dye penetrant. Surface separation shall be acceptable.

4) Longitudinal Cracking: Longitudinal cracks appear as longitudinal lines along the outside bend surface. These are true cracks and show up with dye penetrant. Longitudinal cracks are not acceptable.



Specific exceptions to these rules for structural, aesthetic, human factors or other reasons are to be noted on the part print.

Temporary Note: There will be a lapse time until all exceptions can be identified and appropriately noted on part prints. Engineering asks Manufacturing assistance in policing parts which, by nature, may require exception notes.

Compiled	J. LARSON	SHOP PRACTICE GROUND CLEARANCE REQUIREMENTS	33-00124
Approved	KR HADDOCK		
Issued	1/18/71		
Revised	1-30-84	Chg Ltr G FREIGHTLINER CORPORATION PORTLAND, OREGON	

A. GENERAL

F G

Refer to Engineering Operations Manual 1010 A 00-115.

Some is Eight Inches

B. CLEARANCES, SPECIFIC

Components likely to involve interference with the ground because of size and mounting variations:

G 1. Large diameter fuel tanks - especially sumps, fittings, hoses and supports that may extend below the bottom of the tank shell.

2. Large diameter frame mounted air tanks and associated fittings.

G 3. Lines and brackets in the brake and fuel systems (these must be securely bracketed above the minimum ground clearance).

Engineering must be notified promptly when impaired clearance is discovered and simple correction is not readily obtainable.

Compiled	MURRELL	SHOP PRACTICE AIR LINE COLOR CODING	33-00130 Page 1 of 4
Approved	Purtub		
Issued	2-17-75		
Revised	01/08/91	Chg Ltr C **FREIGHTLINER CORPORATION** PORTLAND, OREGON	PA2024-57

B

The indicated air pressure source is approved for non-air brake use. Does not affect the air brake timing requirements.

SYSTEM	CONSTANT AIR SOURCE	TUBE SIZE	TUBE COLOR IN CAB	
			SUPPLY	DELIVERY
AIR THROTTLE	CAB CONSTANT AIR JUNCTION BLOCK	4	BLUE	BLACK
AIR-O-MATIC POWER STEERING		4	NATURAL	BLACK
AXLE SHIFT DASH MTD CONTROL		4	BROWN	BLACK
A AIR HORN		6	BLACK	
A		4		BLACK
AIR WINDOW		4	NATURAL	BLACK
HEATER WATER AIR SHUT OFF		4	BLUE	BLACK
ENGINE SHUT DOWN		4	BLUE	BLACK
CAT BRAKESAVER CONTROL		4	NATURAL	BLACK
VS GOVERNOR		4	NATURAL	
P.T.O. AIR CONTROL		4	NATURAL	BLACK
OIL MIST LUBE		4	NATURAL	BLACK
5TH WHEEL SLIDE		4	NATURAL	BLACK

ORIGINAL

SYSTEM	CONSTANT AIR SOURCE		TUBE COLOR IN CAB	
			SUPPLY	DELIVERY
TRANSMISSION DASH MTD VALVE	CAB CONSTANT AIR JUNCTION BLOCK	4	BROWN	BLACK
ALL ENGINE MTD COMPONENTS REQUIRING CONSTANT AIR			DO NOT USE RED, GREEN, YELLOW, WHITE OR ORANGE	
A A A WINDSHIELD WIPER-WASHER		4	NATURAL	BLUE-DELIVERY BLACK-EXHAUST TAN-RETURN
AIR SEATS		4	BLUE	
A OIL PRESSURE GAUGE		4		TAN

Compiled	MURRELL	SHOP PRACTICE AIR LINE COLOR CODING	33-00130 Page 3 of 4
Approved			
Issued	2-17-75		
Revised	01/08/91	Chg Ltr C **FREIGHTLINER CORPORATION** PORTLAND, OREGON	PA2024-57

B

	SYSTEM	AIR SOURCE	TUBE SIZE	TUBE COLOR IN CAB	
				SUPPLY	DELIVERY
A	SHUTTERS	FWD. FRAME AIR JUNCTION BLOCK PORT #3	6	BLACK	
A	AIR ACTUATED		6	BLUE	
A	(KYS)AIR FILTERS		6	NATURAL	
C	TRANSMISSION	SECONDARY AIR RES.	6	BLUE	BLACK
	AXLE SHIFT IF DASH MTD VALVE USE -	SECONDARY AIR RES. JUNCTION BLOCK CAB CONSTANT AIR JCT BLOCK	6	BLUE	BLACK
	SUSPENSION IF DASH MTD VALVE USE -	SECONDARY AIR RES. JUNCTION BLOCK CAB CONSTANT AIR JCT BLOCK	6	BLUE	BLACK

ORIGINAL

Compiled	MURRELL	SHOP PRACTICE AIR LINE COLOR CODING	33-00130 Page 4 of 4
Approved			
Issued	2-17-75	Chg Ltr C **FREIGHTLINER CORPORATION** PORTLAND, OREGON	PA2024-57
Revised	01/08/91		

A

SYSTEM	AIR SOURCE	TUBE SIZE	TUBE COLOR	
AIR TOW HITCH	EMERGENCY LINE TP VALVE TO GLADHAND	6	BLACK	
AIR STARTER	FITTING IN CENTER OF SECONDARY RES. AHEAD OF CHECK VALVE.	10	BLACK	

ORIGINAL

Compiled	FREER	SHOP PRACTICE CERTIFICATION LABELS GENERAL	33-00501
Approved	[signature]		
Issued	11-22-71		
Revised	7-30-80	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	

General

The United States and Canadian Federal Governments require that manufacturers of motor vehicles install labels on their vehicles certifying that those vehicles comply with specific regulations imposed by Federal laws. In addition, certain states and provinces have their own labeling requirements.

The following sections will identify, by product type, the labels to be installed and the data to be added.

Caution: The wording, format, material, color, location and all other details of the labels are precisely specified by the respective laws. In all cases, the laws provide potentially heavy penalties for manufacturers who fail to comply with the required procedures and for that reason, the instructions provided below must be followed exactly.

For the purposes of certification, the Freightliner products are divided into broad catagories.

A. Complete Vehicles

These are vehicles that are ready for service when they leave the factory in that no further equipment need to added to make them functional. Examples are:

1. Tractors with fifth wheels installed.
2. Trucks with bodies installed.

B. Chassis-Cab Vehicles

These are vehicles that require additional equipment to be installed in order to be functional. Examples are:

1. Tractors without fifth wheels.
2. Trucks without bodies installed.

C. Service Parts

Gliders and sales cabs are not considered vehicles but service parts and as such, are not required to be certified.

Compiled	B. KOEPKE	SHOP PRACTICE	33-00510
Approved	B. KOEPKE	CERTIFICATION LABELS	
Issued	11-22-91	U.S. TRACTORS, COMPLETE	PAGE 1 OF 1
Revised	07/14/97	Chg Ltr H FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2024-59

U.S. Tractors With or Without Fifth Wheel (complete vehicles)

The above vehicles built in the U.S. factories and intended for use in the U.S. will receive the following label:

G
G
H
G

Label - 24-00273-030, complete vehicle.
Location - D22-21279, LH door frame.

The blanks on the label will be filled in by the computer as part of the A24-00273-000 Label Assy. The 24-00273-030 is to be seperated and installed per the location diagram shown above. Cover labels on door with A24-00475-000 overlay.

1. Date of Manufacture: This will be the chassis start date by month/year; i.e., 6/80.

2. Gross weight Rating: This will be the rating displayed on line 398 of the Manufacturing T.S.O. or appropriate sales order data base also.

3. Gross Axle Ratings: These are the ratings displayed on line 398 of the T.S.O. and should be the lowest figure of those listed on lines 393-396. Note: Second intermediate axles are unique to 8x6 and 8x4 vehicle configurations.

4. Serial Number: This is the last 7 digits of the Vehicle Identification Number.

ORIGINAL

Compiled	B. KOEPKE	SHOP PRACTICE	
Approved	B. KOEPKE	CERTIFICATION LABELS	33-00515
Issued	9-16-85	U.S. TRACTORS & TRUCKS, CHASSIS-CAB	PG 1 OF 2
Revised	01/14/91	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2024-59

U.S. Full Trucks (Chassis-Cab)

The above vehicles are considered chassis-cab vehicles and will receive the following two items:

1. Label - 24-00273-050
   Location - D22-21279, LH door frame.

A 2. Document - A24-00476-000
   - 24-00123, Envelope
   Location - D22-14511, Glove box door.

The blanks on the label will be filled in by the computer as part of the A24-00273-000 Label Assy. The 24-00273-050 is to be seperated and installed
A per the location diagram shown above. Cover Labels with A24-00475-000 overlay.

CHASSIS-CAB MFD. BY VEHICLE ID NUMBER

THIS CHASSIS-CAB CONFORMS TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NOS. 101,102,103,104,106,107,111,113,115,120,121,124,205,206,207,208,209,210,302
THIS VEHICLE WILL CONFORM TO STANDARD NO.
IF IT IS COMPLETED IN ACCORDANCE WITH THE INSTRUCTIONS CONTAINED IN THE INCOMPLETE VEHICLE DOCUMENT FURNISHED PURSUANT TO 49CFR PART 568.
CONFORMITY TO THE OTHER SAFETY STANDARDS APPLICABLE TO THIS VEHICLE WHEN COMPLETED IS NOT SUBSTANTIALLY AFFECTED BY THE DESIGN OF THE CHASSIS-CAB.

24-00273-050

1. Date of Manufacture: This is the chassis start date by month/year; i.e., 6/80.

2. The incomplete vehicle document is completed by applying the computer printed 24-00273-040 Tire & Rim label. Refer to the illustration on PAGE 2.

ORIGINAL

U.S. Tractors w/o Fifth Wheels & Full Trucks (Chassis-Cab) continued

ATTENTION: INTERMEDIATE AND/OR FINAL STAGE MANUFACTURER(S)

(1) THIS CHASSIS – CAB WAS MANUFACTURED BY:

A

FREIGHTLINER CORPORATION
4747 N. CHANNEL
P.O. BOX 3849
PORTLAND, OREGON 97208

FREIGHTLINER OF CANADA, LTD.
4242 PHILLIPS AVENUE
BURNABY, B. C.

(2) THE LAST MANUFACTURING OPERATION WAS PERFORMED ON THIS CHASSIS – CAB ON THE MONTH/YEAR INDICATED BELOW.

(3) THIS DOCUMENT APPLIES TO VEHICLE IDENTIFICATION NO. IDENTIFIED BELOW.

WHEN COMPLETED BY THE FINAL STAGE MANUFACTURER, IT IS INTENDED THAT THIS VEHICLE HAVE THE RATINGS LISTED BELOW.

(24-00273-040 PLACED HERE)

The installation of a body, fifth wheel, and/or other equipment shall be such that the imposed maximum gross weight on any one axle does not exceed the gross axle weight rating shown for that axle. In addition, the imposed gross vehicle weight (chassis, body, equipment, and payload) shall not exceed the gross vehicle weight rating specified in (4) above.

(4) THIS CHASSIS – CAB MAY APPROPRIATELY BE MANUFACTURED INTO A TRUCK.

(5) THE FOLLOWING FEDERAL MOTOR VEHICLE SAFETY STANDARDS ARE APPLICABLE TO THIS VEHICLE AND WERE IN EFFECT AT THE TIME OF MANUFACTURE.

STANDARD	COMPLIANCE STATEMENT
No. 101 – Control Location, Identification and Illumination	This vehicle when completed will conform to Standard No. 101, Control Location, Identification and Illumination, if no alterations are made to the vehicle control including their location, means of identification, and method of illumination.
No. 102 – Transmission Shift Lever Sequence, Starter Interlock and Transmission Braking Effect	This vehicle when completed will conform to Standard No. 102, Transmission Shift Lever Sequence, Starter Interlock and Transmission Braking Effect, if no alterations are made to the shift pattern display(s). If the vehicle is equipped with an automatic transmission, the vehicle will conform if no alterations are made in the transmission, transmission controls, connecting linkages and cables, starting motor, starting motor wiring or plumbing, neutral safety switch and ignition or equivalent switch and related wiring, and shift lever position identifications.
No. 103 – Windshield Defrosting and Defogging Systems	This vehicle when completed will conform to Standard No. 103, Windshield Defrosting and Defogging Systems, if no alterations are made in the windshield defrosting and defogging systems, controls, wiring, plumbing, and air flow to the windshield.
No. 104 – Windshield Wiping and Washing Systems	This vehicle when completed will conform to Standard No. 104, Windshield Wiping and Washing Systems, if no alterations are made in the windshield wiper arms, blades, washer, controls, wiring and plumbing.

ORIGINAL

Compiled	B. KOEPKE	SHOP PRACTICE CERTIFICATION LABEL U.S. GLIDERS	33-00520
Approved	B. KOEPKE		
Issued	11-22-71		
Revised	9-16-85	Chg Ltr E FREIGHTLINER CORPORATION PORTLAND, OREGON	

U.S. Glider Kits

Glider kits are considered items of replacement motor vehicle equipment rather than as vehicles. No certification labels are required by law. Freightliner policy is to install a Tire & Rim label to provide a vehicle identification number. E

Label - 24-00273-040 E
Location - D22-21279

Compiled	F. FREER	SHOP PRACTICE CERTIFICATION LABELS U.S. SALES CABS	33-00525
Approved	[signature]		
Issued	11-22-71		
Revised	7-30-80	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	

U.S. Sales Cabs

Sales cabs are considered items of replacement motor vehicle equipment rather than vehicles. No certification labels are required.

Canadian Tractors W/Fifthwheels (Complete Vehicles)

The above vehicles built in Canada and intended for use in Canada will receive the following items:

G

1. Label - 24-00273-030
   Location - D22-21279, LH Door Frame

2. Safety Mark - A24-00114, Canadian National Safety Mark
   Location - D22-21279, LH Door Frame

G
H

The blanks in the label will be filled in by the computer as part of the A24-00273-000 label. The 24-00273-030 is to be seperated and installed per the location diagram shown above. Cover labels with A24-00475-000 overlay.

A. Date of Manufacture: This will be the chassis start date by month/year; i.e., 6/80.

B. Gross Weight Rating: This will be the rating displayed on line 398 of the Manufacturing T.S.O.

C. Gross Axle Ratings: These are the ratings displayed on line 398 of the T.S.O. and should be the lowest figure of those listed on lines 393-396. Note: Second intermediate axles are unique to 8x6 and 8x4 axle configurations.

D. Vehicle Identification Number: As on the VIN listing.

ORIGINAL

Canadian Tractors W/Fifthwheels (Complete vehicles) Continued

3. Document - MSO156, New Vehicle information statement (NVIS)

   Location - White & green copies in vehicle at time of release, yellow copy to Sales Dept. in Canada.

   Source - Blank forms can be obtained from the Product Engineering Department of Freightliner of Canada.

   The blanks will be filled out as follows: Refer to the illustration on page 3.

   A. Vehicle Identification Number - From the VIN listing #51716

   B. Make - Always "Freightliner"

   C. Model - As shown on TSO line 000.

   D. Model Year - As per 10th digit of the VIN i.e. D = 1983, E = 1984, F = 1985

   E. Color - As per the Basic Color Description Guide Form #MVB-1401, published by the Canadian Conference of Motor Transport Administrators.

   F. No. of Cyl. - Determined by Engine Model.

   G. Motive Power - D - Diesel, G - Gasoline, P - Propane.

   H. Shipping Wt. - In kilograms (LBS. X .45359).

   J. GVWR - As per TSO line 390, in kilograms.

   K. Wheel Base - As per TSO line 126, in millimeters (inches X 25.4).

ORIGINAL

DO NOT WRITE IN THIS AREA

NEW VEHICLE INFORMATION STATEMENT / DESCRIPTION DU VÉHICULE NEUF

Vehicle Identification Number / Numéro d'identification du véhicule (A)	Make / Marque (B)	Model / Modèle (C)	Model Year / Année (D)	Body Type / Type de carrossene

Colour / couleur (E)	No. of Cyl. / Nombre du cyl. (F)	Motive Power Force Motrice (G)	Shipping Wt. (kg.) Masse a l'envoi (H)	G.V.W.R. (kg) M.T.C.I. (J)	Wheelbase (mm) Empattement (K)	Plate Number / Plaque

Manufacturer's / Importer's Name & Location
Nom et adresse du fabricantou / importateur _____

I, the undersigned authorized representative of the company, firm or corporation named below, hereby certify that the new vehicle herein described is assigned on this date for registration to:

Je soussigné, représentant autorisé de la compagnie, firme ou corporation désignée ci-dessous déclare par la présente que le nouveau véhicule décrit ici est cédé à cette date, afin d'être immatriculé, à:

Name of Purchaser(s) / Nom de l'acheteur (Surname / Nom de famille, First / Prenom) Initial / Initiale

Address / Adresse (Street No. or Lot, Conc. and Township / Rue No., ou Lot, Concession et Canton) Apt. No. / App. No Telephone / télephone

Post Office (City, Town or Village and R.R. No.) / Bureau de poste (Ville ou Village et R.R. No.) Postal Code / Code Postal

_____ km

Odometer Reading / kilometr a l'odometre

and certify that the vehicle is new and has not been registered previously:

et Je certifie que ce véhicule est neuf et qu'il n'a pas été immatriculé précédemment:

Dealer's Name
nom de commerçant

Dealer No. /
no de commerçant

Authorized Signature / Signature Autorisée

Day/Jr Mo Yr./An

Date

MS 0156

DEALER COPY

FACTORY COPY

E-45A (10/77)

ORIGINAL

Canadian Tractors w/o Fifthwheels and Full Trucks (Chassis-Cab)

The above vehicles are considered chassis-cab vehicles and will receive the following two items:

1. Document - 24-00121-001, Document
   24-00124-000, Envelope

   Location - D22-14511, Glove Box Door

2. Safety Mark - A24-00114, Canadian National Safety Mark
   Location - D22-21279, LH Door Frame

The blanks in the document will be completed by applying the computer printed 24-00273-040 Tire & Rim label. Refer to the illustration on Page 2.

CANADIAN NATIONAL SAFETY MARK

3. New Vehicle Information Statement (NVIS)
   See 33-00530

ORIGINAL

Canadian Tractors w/o Fifth Wheels & Full Trucks (Chassis-Cab) continued

ATTENTION: INTERMEDIATE AND/OR FINAL STAGE MANUFACTURER

1. This chassis-cab was manufactured by:

FREIGHTLINER OF CANADA LTD.
4242 PHILLIPS AVE.
BURNABY, B.C.

2. The last manufacturing operation was performed on this chassis-cab on the Month/Year indicated below.

3. This document applies to vehicle identification no. indicated below.

When completed by the final stage manufacturer, it is intended that this vehicle have the following ratings listed below.

(24-00273-040 PLACED HERE)

The installation of a body, fifth wheel, and/or other equipment shall be such that the imposed maximum gross weight on any one axle does not exceed the gross axle weight rating shown for that axle. In addition, the imposed gross vehicle weight (chassis, body, equipment, and payload) shall not exceed the gross vehicle weight rating specified in (4.) above.

4. This chassis-cab may appropriately be manufactured into the following vehicle type(s):

☐ TRUCK ☐ TRUCK TRACTOR

5. This vehicle conformed to the following Canadian Federal Motor Vehicle Safety Standards at time of manufacturer.

Safety Standard No's 101, 102, 103, 104, 106, 107, 108, 108.1, 111, 111.1, 113, 115, 120, 121, 124, 205, 206, 207, 208, 209, 210, 302, 1103, 1104, 1106

. This chassis-cab may be used on the public highway for the purpose of transit between its manufacturer and subsequent manufacturers (including distribution incidental thereto) and for no other purpose, until such time as the chassis-cab complies with all Canadian Motor Vehicle Safety Standards applicable to any end use of such vehicle.

ORIGINAL

Compiled	B. KOEPKE	SHOP PRACTICE CERTIFICATION LABELS CANADIAN GLIDERS	33-00540
Approved	B. KOEPKE		
Issued	1-17-72		
Revised	9-16-85	Chg Ltr D FREIGHTLINER CORPORATION PORTLAND, OREGON	

Canadian Glider Kits

Glider kits are considered items of replacement motor vehicle equipment rather than as vehicles. No certification labels are required by law. Freightliner policy is to install a Tire & Rim label to provide a vehicle identification number. D

Label - 24-00273-040 D
Location - D22-21279

Compiled	FREER	SHOP PRACTICE CERTIFICATION LABELS CANADIAN SALES CABS	33-00545
Approved	[signature]		
Issued	1-17-72		
Revised	7-30-80	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	

Canadian Sales Cabs

Sales cabs are considered items of replacement motor vehicle equipment rather than vehicles. No certification labels are required.

Compiled	FREER	SHOP PRACTICE CERTIFICATION LABELS U.S. TRUCKS, COMPLETE	33-00550
Approved	Koepke		
Issued	12-6-71		
Revised	4-15-83	Chg Ltr F FREIGHTLINER CORPORATION PORTLAND, OREGON	

F

U.S. Trucks Complete (with body installed)

Contact Corporate Engineering for a listing of appropriate labels and documents.

Compiled	B. KOEPKE	SHOP PRACTICE	
Approved	B. KOEPKE	CERTIFICATION LABELS	33-00555
Issued	7-30-80	TIRE & RIM LABELS	PG 1 OF 1
Revised	01/14/91	Chg Ltr D FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2024-59

C ↓

U.S. & Canada Vehicles

All vehicles must carry the label listed below. Location will depend upon whether the vehicle is complete or incomplete.

Definition:

Complete Vehicle:
U.S. - Tractors, with or without fifth wheel.
Canada - Tractors with fifth wheels.

Incomplete Vehicle:
U.S. - Trucks
Canada - Trucks and tractors without fifth wheels.

Label - 24-00273-040
Location:
Complete Vehicle - D22-21279 LH Door Frame
Incomplete Vehicle - A24-00476-000 insert per 33-00515

D

Blanks will be filled in by the computer as part of the A24-00273-000 label assembly. The 24-00273-040 is detached and affixed as per the locations shown above.

Procedure:

There are exceptional cases when the computer printed label cannot be used. The program assumes that all front axles, including the second axle on a tandem steer unit, have single tires and that all non-steering axles have dual tires. If a vehicle has a non-steering axles that uses single tires, the computer printed 24-00273-040 must be discarded and a new one typed. Information for the label is obtained from the T.S.O. or appropriate data base. The tire and rim data for each dual and single tire rating is listed on the Engineering Drawing for A24-00273. Canadian vehicles must display KG for load and PSI for inflation pressure. Each axle must have tire and rim information listed.

ORIGINAL

Compiled	B. KOEPKE	SHOP PRACTICE CERTIFICATION LABELS NOISE EMISSION	33-00565
Approved	B. KOEPKE		
Issued	7-30-80		
Revised	9-16-85	Chg Ltr C	FREIGHTLINER CORPORATION PORTLAND, OREGON

Vehicle Noise Emission Control

All U.S. vehicles are to receive a noise emissions label.

Label - 24-00273-020 label.

Location - Back of LH Sunvisor per 33-18118

C Procedure - The date of manufacture is printed by the computer as part of the A23-00273-001 label. The 24-00273-020 is to be seperated and installed per the location shown above.

PART NO. 24-00273-010

VEHICLE NOISE EMISSION CONTROL INFORMATION

FREIGHTLINER CORPORATION FREIGHTLINER DATE OF MANUFACTURE
THIS VEHICLE CONFORMS TO U.S. EPA REGULATIONS FOR NOISE EMISSION APPLICABLE TO MEDIUM AND HEAVY TRUCKS.
THE FOLLOWING ACTS OR THE CAUSING THEREOF BY ANY PERSON ARE PROHIBITED BY THE NOISE CONTROL ACT OF 1972:
A. THE REMOVAL OR RENDERING INOPERATIVE, OTHER THAN FOR PURPOSES OF MAINTENANCE, REPAIR, OR REPLACEMENT, OF ANY NOISE CONTROL DEVICE OR ELEMENT OF DESIGN (LISTED IN THE OWNER'S MANUAL) INCORPORATED INTO THIS VEHICLE IN COMPLIANCE WITH THE NOISE CONTROL ACT.
B. THE USE OF THIS VEHICLE AFTER SUCH DEVICE OR ELEMENT OF DESIGN HAS BEEN REMOVED OR RENDERED INOPERATIVE.

24-00273-020

Compiled	B. KOEPKE	SHOP PRACTICE	33-00615
Approved	B. KOEPKE	CERTIFICATION LABELS	
Issued	7-30-80	U.S. EXPORT TO CANADA	
Revised	9-16-85	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	

A. Complete Vehicles: These will receive the following labels.

C 1. Label - 24-00273-030, Complete Vehicle
24-00273-040, Tire & Rim

Location - D22-21279, LH Door Frame

2. Safety Mark - A24-00114, Canadian National Safety Mark

Location - D22-21279, LH Door Frame

Procedure

C a. Label 24-00273-030 is completed as per 33-00530.

C b. Label 24-00273-040 is completed as per 33-00555 and applied to 24-00078-001.

B. Chassis-Cab Vehicles (Includes trucks and tractors w/o fifth wheels): These will receive the following labels.

1. Labels:

Label - 24-00078-001, Insert
- 24-00124, Envelope

Location - D22-14511, Glove Box Door

C 2. Safety Mark - A24-00114, Canadian National Safety Mark

Location - D22-21279, LH Door Frame

Procedure

C a. Label 24-00078-001 is completed as per 33-00535.

C b. Label 24-00273-040 is completed as per 33-00555 and applied to 24-00078-001.

C. All Vehicles:

1. Label - 24-00125 U.S. Production Export

Location - RH Door Glass

2. New Vehicle Information Statement
See 33-00530

Compiled	B. KOEPKE	SHOP PRACTICE	33-00620
Approved	B. KOEPKE	CERTIFICATION LABELS	
Issued	6-23-80	CANADIAN EXPORT TO U.S.	
Revised	4-15-83	Chg Ltr D FREIGHTLINER CORPORATION PORTLAND, OREGON	

A. Complete Vehicles: These will receive the following labels.

1. Label - 24-00273-030, Complete Vehicles
   - 24-00273-040, Tire & Rim

   Location - D22-21279, LH Door Frame

2. Safety Mark - A24-00114, Canadian National Safety Mark

   Location - D22-21279, LH Door Frame

   Procedure

   a. Label 24-00273-030 is completed as per 33-00510.

   b. Label 24-00273-040 is completed as per 33-00555 and applied to A24-00107-001.

B. Chassis-Cab: These will receive the following labels.

1. Label - A24-00107-001, Insert

   Location - D22-14511, Glove Box Door

2. Safety Mark - A24-00114, Canadian National Safety Mark

   Location - D22-21279, LH Door Frame

   Procedure

   a. Label 24-00273-030 is completed per 33-00515.

   b. Label 24-00273-040 is completed as per 33-00555 and applied to A24-00107-001.

COMPILED	PHILLIPS	SHOP PRACTICE	SECTION NUMBER
APPRV	LOUTZ		33-00625
ISSUE DATE	07/30/80	FLEXIBLE LINE ROUTING	PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	A		

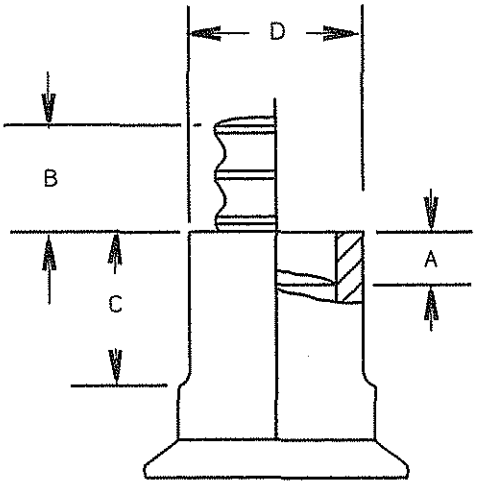
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0000-008 FOR FLEXIBLE LINE ROUTING.

Compiled	Phillips	SHOP PRACTICE FLEXIBLE LINE ROUTING	33-00625
Approved	[signature]		
Issued	7-30-80		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

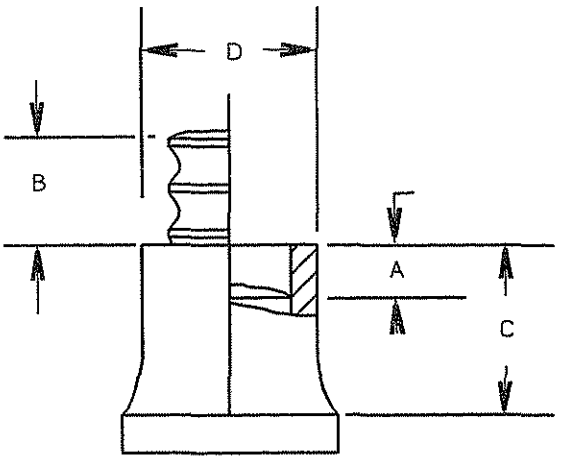
All flexible lines must be routed so that routinely serviceable components (i.e., fuel filters, fuel water separators, oil filters, air cleaners, dip sticks, belt drives) can be readily accessed for adjustment or element removal without the need to relocate or remove any lines.

COMPILED	ERK	SHOP PRACTICE MANUAL HUCK INSPECTION DATA	SECTION NUMBER 33-00626
APPRV	ANF		
ISSUE DATE	11/22/89		PAGE 1 OF 6
REV DATE	03/11/93	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		P6096H-01

HUCK BOLT INSPECTION DATA FOR GRADE #2 FASTENERS AND COLLARS.



3LC FLANGED COLLAR



2LC COLLAR

TABLE I

NOMINAL SIZE	FASTENER (PIN)	COLLAR	A MAX	B MAX	C MIN	D DIA. MAX
3/16	C6L	2LC & 3LC	5/64	1/8	11/64	.276
1/4			5/64	5/32	1/4	.364
5/16			9/64	7/32	9/32	.454
3/8			1/8	9/32	11/32	.552

LOGON ID=

INSPECTION DATA FOR GRADE 8 HUCK BOLT FASTENERS AND COLLARS.

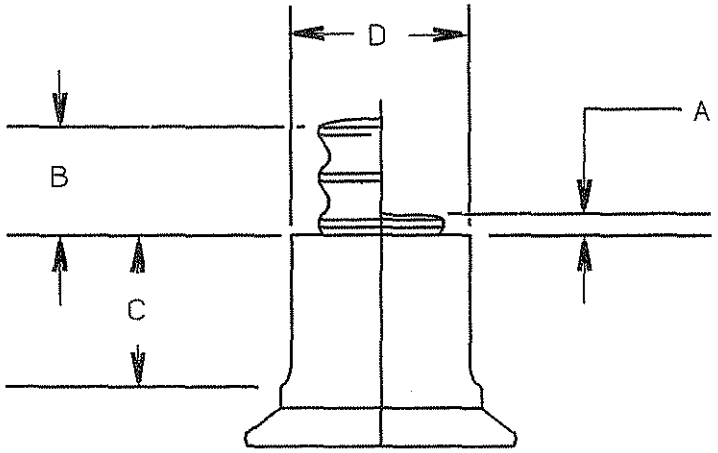


TABLE II

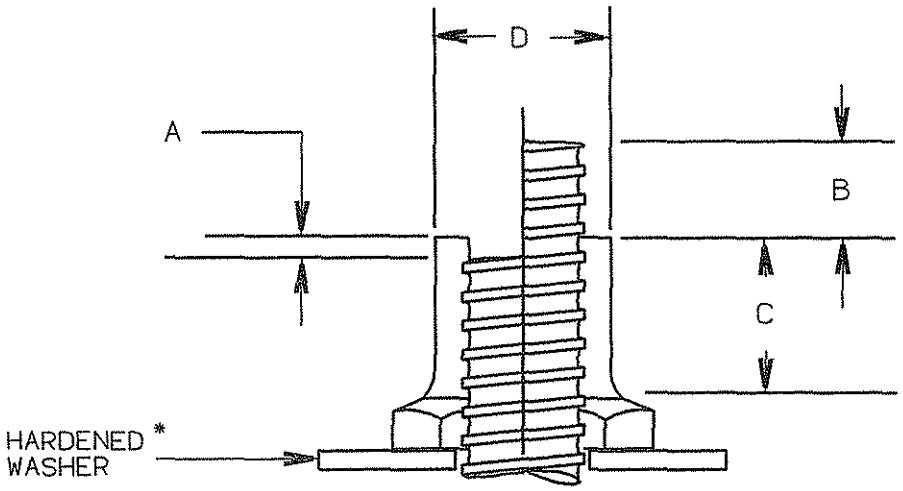
NOMINAL SIZE	FASTENER (PIN)	COLLAR	A MIN	B MAX	C MIN	D MAX
1/2	HP8F-DT16	HPCF-R16	.100	.650	.563	.763
5/8	HP8F-DT20	HPCF-R20	.120	.670	.688	.951
3/4	HP8F-DT24	HPCF-R24	.120	.670	.813	1.139

A PROPERLY INSTALLED HUCKBOLT FASTENER WILL POSSESS THE DIMENSIONAL CHARACTERISTICS TABULATED IN TABLES I AND II. SHOULD THE DIMENSIONS "A" OR "B" EXCEED THE INDICATED VALUES, THE FASTENER IS BEING USED OUT-OF-GRIP. A "C" DIMENSION LESS THAN THE VALUES SPECIFIED IS AN INDICATION OF INCOMPLETE SWAGE. A "D" DIMENSION EXCEEDING THE TABULATED VALUES IS AN INDICATION OF AN INCORRECT OR WORN ANVIL ON THE INSTALLATION TOOL.

BECAUSE OF DESIGN MARGIN BUILT INTO THE FASTENER AND UNUSUAL FIELD CONDITIONS, FAILURE OF AN INSTALLED FASTENER TO MEET THE ABOVE DIMENSIONAL CRITERIA IS NOT NECESSARILY AN INDICATION OF AN IMPROPERLY INSTALLED ASSEMBLY. CONVERSELY, A HUCKBOLT PIN INSTALLED IN A PROPERLY PREPARED HOLE WITH THE RECOMMENDED SINGLE CYCLE DRIVING TOOL, WHICH SWAGES THE LOCK COLLAR MATERIAL INTO THE LOCKING GROOVES ON THE PIN AND BREAKS OFF THE PINTAIL AT THE BREAK-NECK GROOVE, WILL ALWAYS POSSESS AT LEAST THE MINIMUM GUARANTEED STRENGTH CHARACTERISTICS WHEN THE DIMENSIONAL LIMITS OF THE TABLES ARE MET.

SON ID=

B INSPECTION DATA FOR "HUCK-FIT" FASTENERS AND COLLARS.



HEX FLANGE

SHOULD "A", "B", OR "E" DIMENSIONS EXCEED THE GIVEN VALUES, THE FASTENER IS OUT-OF-GRIP. A "C" DIMENSION LESS THAN THE GIVEN VALUE INDICATES AN INCOMPLETE SWAGE. A "D" DIMENSION GREATER THAN THE GIVEN VALUES INDICATES AN INCORRECT OR WORN ANVIL ON THE INSTALLATION TOOL.

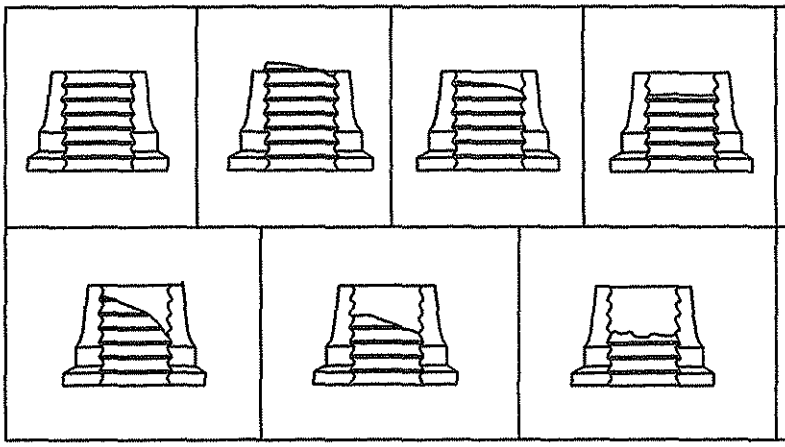
TABLE III

NOMINAL SIZE	PIN NUMBER	COLLAR NUMBER	A MAX	B MAX	C MIN	D MAX
1/2	HFF-DT16	HCH-R16U	.03	.53	.56	.760
5/8	HFF-DT20	HCH-R20U	.03	.53	.73	.945
3/4	HFF-DT24	HCH-R24U	.03	.53	.86	1.132
7/8	HFF-DT28	HCH-R28U	.03	.53	.96	1.312
1	HFF-DT32	HCH-R32U	.03	.53	1.11	1.507

A PROPERLY INSTALLED HUCK FASTENER WILL POSSESS THE DIMENSIONS GIVEN HERE. VISUAL INSPECTION IS SUFFICIENT.

* NOTE: A HARDENED WASHER IS REQUIRED UNDER "HUCK FIT" COLLARS.

INSPECTION DATA FOR MAGNAGRIP FASTENERS AND COLLARS

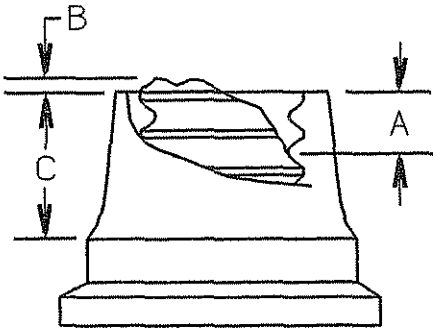


ACCEPTABLE FRACTURES

SUBSTANTIALLY FLUSH WITH END OF COLLAR UP TO MAXIMUM OF TWO LOCK WITNESS MARKS WITHIN COLLAR.

UNACCEPTABLE FRACTURES

THREE WITNESS MARKS WITHIN COLLAR.



HUCK PIN PART NO.	USE WITH HUCK COLLAR PART NO.	NOM DIA.	A REF. MAX.	B REF. MAX.	C MIN.
MGP-R6	MGC-R6	.188	.063	.031	.170
MGP-R8	MGC-R8	.250	.125	.031	.203

DIMENSION "A" IS AN APPROXIMATION AND IS FURNISHED TO AUGMENT INSPECTION BY WITNESS MARK. FULL MECHANICAL VALUES ARE ASSURED WHEN WITNESS MARKS ARE "TWO MAX." MEASUREMENT OF DEPRESSION "A" AND PROJECTION "B" SHOULD BE CONSIDERED REFERENCE, COSMETIC, INFORMATION.

A PROPERLY INSTALLED MAGNA-GRIP HUCK FASTENER WILL POSSESS THE DIMENSIONAL AND VISUAL CHARACTERISTICS TABULATED ABOVE. A "C" DIMENSION LESS THAN THE VALUES SPECIFIED IS AN INDICATION OF INCOMPLETE SWAGE.

BECAUSE OF DESIGN MARGIN BUILT INTO THE FASTENER AND PECULIAR FIELD INSTALLATION CONDITIONS, FAILURE OF AN INSTALLED FASTENER TO MEET THE ABOVE DIMENSIONAL CRITERIA IS NOT NECESSARILY AN INDICATION OF AN IMPROPERLY INSTALLED ASSEMBLY. CONVERSELY, A MAGNA-GRIP HUCK PIN INSTALLED IN A PROPERLY PREPARED HOLE WITH THE RECOMMENDED SINGLE CYCLE DRIVING TOOL, WHICH SWAGES THE LOCK COLLAR MATERIAL INTO THE LOCKING GROOVES OF THE PIN AND BREAKS OFF THE PINTAIL WILL ALWAYS POSSESS AT LEAST THE MINIMUM GUARANTEED STRENGTH CHARACTERISTICS WHEN THE DIMENSIONAL VISUAL LIMITS OF THE ABOVE TABULATIONS ARE MET.

HUCK BOLT CALLOUTS: WHEN HUCK BOLTS OR HUCK FITS ARE SPECIFIED ON THE CHASSIS, THEY ARE TO BE INSTALLED AS FOLLOWS:

1) GROUP 05 (COOLING)

RADIATOR STRUT BRACKET TO FRAME.

2) GROUP 07 (TRANSMISSION)

TRANSMISSION SUPPORT BRACKETS TO FRAME.

3) GROUP 10 (FRONT AXLE)

A) FRONT SHOCK ABSORBER BRACKET TO FRAME.
B) REAR SHOCK BRACKET IF THEY ARE SPACED OUT WITHIN THE RANGE OF HUCK BOLT LENGTHS STOCKED.

4) GROUP 15 (CHASSIS)

A) GUSSETS AND STRUTS TO CROSSMEMBERS - CROSSMEMBERS TO FRAME.
B) REAR TOWING CROSSMEMBER TOGETHER - CROSSMEMBER TO FRAME.
C) FIFTH WHEEL ANGLES TO FRAME, SINGLE LOCATION ONLY.
D) ALL QUARTER FENDER BRACKETS EXCEPT STUB MOUNTED(SINGLE HOLE) AND OVER-THE-CASTING TYPE.
E) NON-RIGID CROSSMEMBER(MIDSHIP BEARING SUPPORT) TO FRAME.
F) DO NOT HUCK BOLT THE UNDERSLUNG CROSSMEMBER WHEN IT TIES TO THE ENGINE MOUNT.
G) DO NOT HUCK BOLT THE SAFETY CHAIN ATTACHMENT OR THE TOW HITCH.
H) DO NOT HUCK BOLT A CHROME OR STAINLESS STEEL FRAME ATTACHMENT BRACKET.

5) GROUP 16 (SUSPENSION)

A) FRONT SUSPENSION SHACKLE BRACKET FRAME RAIL WEB HOLES ONLY.
B) REAR SUSPENSION CASTINGS TO FRAME EXCEPT REAR CASTING OF ALL FREIGHTLINER SPRING, REYCO SPRING, AND SINGLE AXLES WITH SINGLE LEAF SPRINGS. C
C) REAR SUSPENSION CROSSMEMBERS TOGETHER AND TO FRAME.
D) REAR SUSPENSION AIR BAG BRACKETS TO FRAME(F/L AIR RIDE ONLY).

6) GROUP 18 (CAB)

A) OUTBOARD CAB MOUNTS TO FRAME.

ALL HUCK COLLARS ARE TO BE OUTBOARD UNLESS PREVENTED BY A CLEARANCE PROBLEM.

DO NOT INSTALL HUCK COLLARS ON THE TOP OF "C" CHANNEL X/M'S IN THE BACK OF CAB ACCESS AREA UNLESS THEY ARE COVERED BY A TREADPLATE, SUSPENSION X/M'S EXCLUDED.

WHEN HUCK BOLTING AN ASSEMBLY TO THE FRAME, ALL FRAME FASTENERS ARE TO BE HUCK BOLTS. IF THIS IS NOT POSSIBLE, CONTACT ENGINEERING FOR APPROVAL.

IF HUCK BOLT HEAD INTERFERENCE EXISTS BETWEEN A CROSSMEMBER AND A PLATE MOUNTED FIFTH WHEEL, USE THE TRUSS HEAD LOW PROFILE HUCK BOLTS. IF THIS IS NOT POSSIBLE, CONTACT ENGINEERING FOR APPROVAL.

NOTE: ONLY GRADE 8 HP8F SERIES HUCK BOLTS ARE TO BE USED ON FRAME ATTACHMENTS.

TE= 3/23/93 TIME=13.25 ACCESS=NONE
ION ID=

Compiled	F.FREER	SHOP PRACTICE ENGINE, CONTENTS	33-01100
Approved	DCR		
Issued	06/18/73		
Revised	07/21/88	Chg Ltr AR FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-38

PRACTICE NO.	DESCRIPTION
33-01101	ENGINE, PREPARATION
33-01104	THROTTLE LINKAGE ADJUSTMENT, MEDIUM CONVENTIONAL
33-01106	DIPSTICK INSTALLATION/OIL FILER
33-01107	THROTTLE INSTALLATION, MECHANICAL, LONG CONV. & COE
33-01108	FLYWHEEL HOUSING INSTALLATION
33-01109	TORQUING OF SCREW FASTENERS
33-01111	ENGINE PREPARATION, BREATHER VALVE
33-01112	THERMAL SWITCH LOCATIONS, CAT
33-01113	EMERGENCY SHUTDOWN, DDE, TESTING
33-01114	FLYWHEEL REMOVAL & INSTALLATION, CUMMINS
33-01115	OIL FILTERS, BY PASS
33-01116	AIR STARTER INSTALLATION
33-01117	MVT GOVERNOR PLUMBING
33-01118	JACOBS BRAKE
33-01119	GLOW PLUG, FUEL SUPPLY
33-01120	TURBOCONVEYOR WARNING
33-01121	ACCESSORY DRIVE, CUMMINS NTC SERIES
33-01122	ALTERNATOR INSTALLATION
33-01123	ENGINE SUPPORTS, REAR
33-01124	RETARDER CONTROLS
33-01125	SHUTDOWN, AIR
33-01126	AIR COMPRESSOR
33-01127	FREON COMPRESSOR INSTALLATION
33-01128	TACHOMETER DRIVES
33-01129	OIL FILTER, FULL FLOW, REMOTE MOUNTED
33-01130	THERMAL SWITCH LOCATIONS, CUM L-10
33-01131	SERVICE ACCESSIBILITY, CAT 3406B
33-01132	CAT PEEC AIR RESTRICTION CONNECTION
33-01133	CHARGE AIR COOLER HOSES
33-01134	CAT PEEC ACCELERATOR INSTALLATION AND ADJUSTMENT

COMPILED	ERK	SHOP PRACTICE ENGINE PREPARATION	SECTION NUMBER 33-01101
APPRV	ANF		
ISSUE DATE	06/15/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	W		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-001 FOR ENGINE PREPARATION.

A. Flywheel Cleaning

Using a good solvent, remove from the inside of the flywheel and flywheel housing all dirt and rust preventive materials. Be especially careful to clean all mounting surfaces and dry carefully. Clean also any adjacent parts that might be a source of recontamination before installation.

B. Oil Pan Drain

At engine build-up, remove drain plug and completely drain all run-in oil, water and other contaminants from the engine pan.

C. Air Induction System

Every precaution must be taken to avoid entry of dirt into the system, both in the partially assembled state (when the engine is particularly vulnerable to airborne dust and accidental entry of dirt, chips, etc.), and after assembly and in operation (when soundness of joints and freedom from leakage is the chief concern).

Before attaching components to the engine, any openings involved should be cleared of dirt or moisture. Joints and mounting surfaces should be checked at assembly to avoid misalignment or leakage due to dirt or damage. (For Air Intake System Installation, see 03 Group).

D. Accessory Installations

Certain accessory parts are customarily or occasionally attached to some part of the engine structure:

1. When parts are mounted on spotfaced areas, follow the procedures outlined in 33-00109 paragraph 13 (filling of gaps).
2. Adequate distance is maintained from moving parts, high temperature surfaces, electric wiring and bare terminals, points that require inspection or service, and that there is no undue obstruction to ambient air flow nor interference with simple routing of tubing and wiring.
3. Supports for heat sensitive parts are not attached to heat sources.
4. The part is not subject to, nor will it cause, damage from leakage, accumulation of dirt or moisture, or other harmful conditions associated with its attachment, servicing or failure in operation. (For specific installations, see Accessory Group 22).

E. Piping Modification (Coolant, Lubrication, Air Intake, Exhaust)

All piping modifications on the engine are to be made according to Engineering Specifications or to standard Manufacturers' Instructions.

D

REVISED & RETYPED TO CHANGE

F. Pulleys and Belts

a. Installation - General

1. Always shorten the distance between pulley centers so the belt can be installed without forcing. Never roll or tighten a belt over a pulley and never pry it on with a tool such as a screwdriver. Either of these methods will damage a belt and cause its early failure. Diagonal cuts on a failed belt indicate that the failure was caused by rolling a tight belt over the pulley. Cuts from prying a belt in place may be either diagonal or vertical.

2. Always install pairs of belts in complete sets to prevent early failure and to provide efficient operation. Belt riding depth should not vary over 1/16 inch on matched belt sets.

3. Pulley misalignment must not exceed 1/16 inch for each foot of distance between pulley centers. *

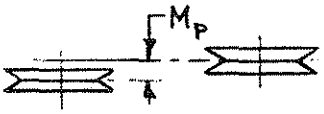
4. A belt should not bottom in the pulley groove nor should it protrude over 3/32 inch above the top edge of the groove.

5. Do not let belts rub adjacent parts.

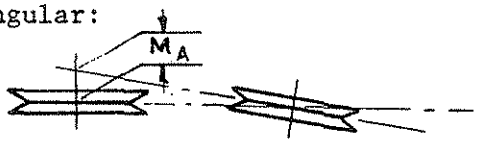
6. Alternator pulley must be hand tightened; impact wrench use will damage alternator diodes. (Ref. 33-01101 p. 3)

*Measurement of Misalignment, M, of Vee-Belt pulleys:

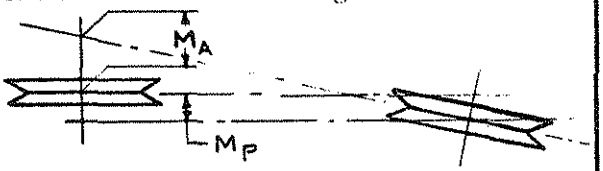
1. Parallel:



2. Angular:



3. Combined Parallel & Angular:



$M = M_A + M_P$

(Note: Add values, even if offsets are opposite.)

A REVISED AND RETYPED 'E' Change

F. Pulleys & Belts (cont.)

b. Belt Tension Tighten belts as shown below:

ENGINE	BELT	BELT TENSION (LBS.)	
		INITIAL	AFTER RUN IN
CUMMINS	3/8"	140	100
	1/2"	140	100
	3/4"	140	100
	7/8"	140	100
	POLY "V"	150	130
CAT	3/8"	100 + 5	45 ± 5
	½",3/4",15/16"	120 ± 5	90 ± 10
DDE	FAN	60-80	-
	(2)A LT, DR 3/8", ½"	40-50	-
	(1) ½	50-70*	-
	POLY "V"	310 - 360**	-

* Use belt tension gage #BT-33-73 FA, or equivalent.

** Use belt tension gage #BT-33-AE6-40A, range 40-600 lbs, or equivalent.

M AIR CONDITIONER COMPRESSOR BELT (S)

Maximum tension is 100 ft/lbs after run in.

REVISED & REDRAWN 'K' CHANGE

F. Pulleys & Belts (cont.)

d. Belt Length

T Note carefully whether adequate takeup remains so that proper tension can be maintained for the life of the belt. More takeup is needed for longer belts. Notify Engineering whenever remaining belt takeup seems too low.

e. Cleanliness and Freedom from Damage

Keep belts and sheaves free from any foreign material which may cause slippage. A dirty belt can be cleaned by wiping it with belt cleaner or hydraulic fluid.

Belts must be free of cuts and other damage. A damaged belt should be replaced; cuts and tears greatly reduce service life.

Pulley grooves should be free of roughness or damage that might reduce belt life.

S G. Lifting the Engine

In the interest of safety of personnel, and to prevent damage to the engine, engines are to be lifted only by approved lifting hooks (or rings) and supported by engine structure provided for the purpose.

When using a lifting eye other than as provided by the engine manufacturer, the bolts used to attach the eye must reach to within 1/4" of the depth of full thread, or in the case of a through bolt, the new bolt length must be the length of the bolt removed plus the thickness of the apparatus added.

H. Engine Parts Rework

No removable part involving passages to the interior of the engine may be reworked in place on the engine. A reworked part should always be rechecked for foreign matter just before reinstalling it on the engine.

Any rework that must be done on parts not removable from the engine and involving passages leading to the interior of the engine shall be done with adequate precautions taken to prevent entry of any foreign matter, or to remove it completely as soon as after rework is completed.

Repaint as per 33-00113.

REVISED & RETYPED 'C' CHANGE

COMPILED	W A	SHOP PRACTICE THROTTLE LINKAGE ADJUSTMENT	SECTION NUMBER 33-01104
APPRV	HIELESON		
ISSUE DATE	09/16/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-002 FOR THROTTLE LINKAGE ADJUSTMENT.

Compiled	WILSON-ASH	SHOP PRACTICE	
Approved	HEILESON	THROTTLE LINKAGE ADJUSTMENT	33-01104
Issued	9-16-85	MEDIUM CONVENTIONAL	
Revised	12-14-87 Chg Ltr A	FREIGHTLINER CORPORATION PORTLAND, OREGON	

ACCELERATOR LINKAGE ADJUSTMENT PROCEDURE - CUMMINS ENGINES

1. On the engine fit-out line, set the fuel pump lever to the following values:

   L-10 Series:

   28 counter-clockwise from 12 o'clock (Ref. 681 301 06 A1).

   NTC Series:

   10 conter-clockwise from 12 o'clock (Ref. 681 301 06 A1).

   a) Loosen the clamping bolt on the fuel pump lever.
   b) Rotate fuel pump shaft clockwise until it rests against the internal stop.
   c) Place the special index gauge on top of the pump.
   d) Set the lever to the proper angle.
   e) Tighten the clamping bolt on the fuel pump lever.

2. With no occupants in the cab, and the fuel pump lever at idle position, set the gap to 1/8" between the stop pin and the slide bushing of the throttle pedal.

   a) Disconnect the throttle rod assembly from the fuel pump lever.
   b) Loosen the jam nuts on the throttle rod.
   c) Adjust the overall length of the throttle rod by screwing the rod end bearings in or out. Shortening the overall length of the throttle rod will increase the gap between the stop pin and the slide bushing. Lengthening it will decrease the gap. Nominal length for the NTC is 25½", for the L10 29 3/8".
   d) Attach the throttle rod to the pump lever and recheck the gap.
   e) When the 1/8" is obtained, secure the throttle rod assembly to the fuel pump lever and tighten the jam nuts.

A 3. Set the break-over of the fuel pump lever to approximately 5°.

   a) Apply a dead weight onto the throttle pedal. Make sure the pedal rests against the pedal stop in the cab floor.
   b) Pull back on the throttle lever rod and observe if the desired break-over is present.
   c) Adjust the pedal stop until the desired break-over is achieved.

Compiled	F. Freer	SHOP PRACTICE ENGINE LUBRICATION	33-01105
Approved	LM		
Issued	3-8-68		
Revised	4-4-80	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	

1. ENGINE OIL is specified on the Vehicle Lubrication Chart, form E-47 current revision, as illustrated in 33-00102.

A 2. WATER PUMPS are pre-lubed and sealed by the engine manufacturer. Lube fittings are not to be installed unless specified on the Specification Sheet.

COMPILED	ERK	SHOP PRACTICE DIPSTICK INST./OIL FILL	SECTION NUMBER 33-01106
APPRV	ANF		
ISSUE DATE	06/11/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	H		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-003 FOR DIPSTICK INST./OIL FILL.ENT.

COMPILED	ERK
APPRV	ANF
ISSUE DATE	06/11/86
REV DATE	10/25/95
CHG LTR	G

SHOP PRACTICE

DIPSTICK INSTALLATION AND OIL FILL

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-01106

PAGE
1 OF 1

PF1006-09

A. DIPSTICK INSTALLATION

PRODUCTION DISPSTICKS AND DIPSTICK TUBES ARE SUPPLIED AS A PRE-MARKED ASSEMBLY.

B. OIL FILL

1. FILL ENGINE WITH QUANTITY OF OIL INDICATED UNDER THE HIGH CAPACITY COLUMN OF THE ENGINE OIL CAPACITY TABLE SHOWN BELOW.
2. START ENGINE AND RUN AT FAST IDLE FOR A FEW MINUTES TO FILL OIL LINES AND FILTERS.
3. SHUT OFF ENGINE AND LET STAND FOR 15 MINUTES TO ALLOW OIL TO DRAIN BACK INTO OIL PAN.
4. FILL CRANKCASE SO THAT THE OIL LEVEL IS AT LEAST 3/4 OF THE DISTANCE FROM THE LOW MARK TO THE HIGH MARK. DO NOT FILL BEYOND THE HIGH MARK.
5. VEHICLE CAN NOW BE OPERATED.

ENGINE OIL CAPACITIES

ENGINE	U.S.						METRIC		
	HIGH		LOW		DIFF		HIGH	LOW	DIFF
	GAL*	QT	GAL*	QT	GAL*	QT	LITERS	LITERS	LITERS
CATERPILLAR									
3306	9.5	38	8.0	32	1.5	6	36.1	30.4	5.7
3406	8.5	34	7.0	28	1.5	6	32.2	26.5	5.7
3406 W/BRAKE SAVER	6.5	26	5.0	20	1.5	6	24.5	19.0	5.5
3176	6.5	26	5.5	22	1.0	4	24.5	21.0	3.5
C10/C12	8.0	32	7.0	28	1.0	4	30.3	26.5	3.8
CUMMINS									
L-10/M11	9.0	36	7.0	28	2.0	8	34.0	26.5	7.5
N-14	9.5	38	8.0	32	1.5	6	36.0	30.4	5.6
C SERIES	5.0	20	4.0	16	1.0	4	19.0	15.0	4.0
DETROIT DIESEL									
6L-71 SERIES	5.5	22	4.5	18	1.0	4	21.0	17.0	4.0
6V-92 SERIES	5.0	20	4.0	16	1.0	4	19.0	15.0	4.0
8V-92 SERIES	5.75	23	4.25	17	1.5	6	22.0	16.0	6.0
50 SERIES	5.5	22	4.75	19	.75	3	21.0	18.0	3.0
60 SERIES	8.0	32	6.5	26	1.5	6	30.4	24.7	5.7

* FOR IMPERIAL GALLONS, DIVIDE THE U.S. GALLON VALUE BY 1.2, I.E., IMPERIAL GALLON MEASUREMENT FOR A CUMMINS N-14 IS 7.92 GALLONS (9.5 GALLONS ÷ 1.2).

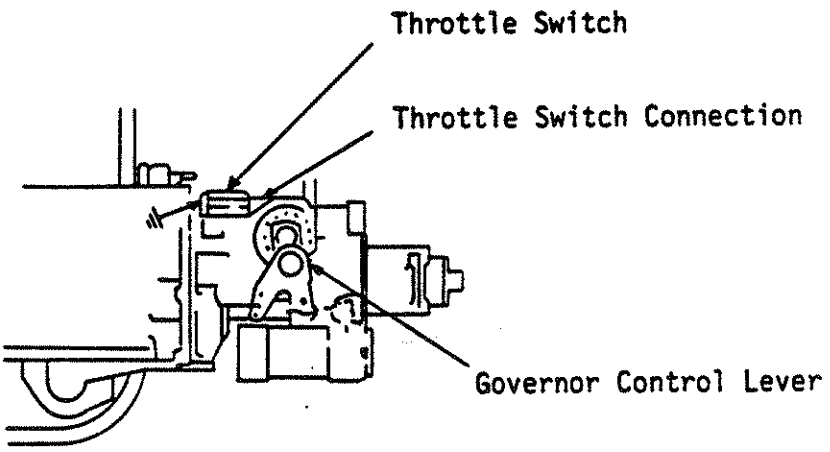
COMPILED	LEVINGS	SHOP PRACTICE THROTTLE CONTROLL INST. MECHANICAL	SECTION NUMBER 33-01107
APPRV	HEILESON		
ISSUE DATE	09/16/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-004 FOR THROTTLE CONTROL INST. MECHANICAL.

Compiled	LEVINGS	SHOP PRACTICE THROTTLE CONTROL INSTALLATION MECHANICAL	33-01107
Approved	HEILESON		
Issued	9-16-85		
Revised	6-11-86	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	

Throttle Switch Installation on CAT Engines with Brakesaver

TO
SOLENOID
VALVE



1. Remove set screw & nut from switch connection (3/8 - 16 UNC tapped hole), which is located inboard of the governor control lever on the governor housing.

2. Screw nut from set screw onto throttle switch (Ref: CAT/6N6711). Then screw entire assembly into housing.

3. With engine running, use throttle switch as low idle stop and adjust to 600 RPM.

4. Tighten locking nut securely.

REVISED & REDRAWN 'A' CHANGE

A A. CHANGING THE FLYWHEEL HOUSING

Although it is not a frequent nor a regular procedure to change the flywheel housing on an engine, this operation must occasionally be performed by a Freightliner Shop. The procedure given below is for engines with simple flywheel housings; changing of combined gear-case and flywheel housings will usually not be undertaken as a Freightliner shop operation. After making sure that exchange or rebuilding of the engine by the manufacturer is not a simpler alternative, then take these steps:

1. Check that the flywheel housing to be installed is the correct one for the proposed installation. Also, go over it carefully to be sure it is free of damage and that it is within proper tolerances of flatness, diameter, hole size, etc. Pay special attention to the mounting faces, tapped holes and proper starter location. (See Table I for SAE Standard flywheel housing dimensions.)

TABLE I
FLYWHEEL HOUSING DIMENSIONS
from SAE STANDARD J617a

SAE NO.	A BORE (I.D.)	TOLERANCE			B (O.D.)	C (B.C.)	E PILOT BRG. BORE DEPTH	TAPPED HOLES	
		BORE DIA. -0.000	BORE ECCEN-TRICITY	FACE DEVIA-TION				No.	Size
1	20.125	+.005	.008		21.75	20.875	3.94*	12	7/16-14
2	17.625	+.005	.008		19.25	18.375	3.94	12	3/8-16
3	16.125	+.005	.008		17.75	16.875	3.94	12	3/8-16

* 5.25 in. optional for multiple plate clutch.

2. Mounting capscrews, if undamaged, may be re-used. If replacement is necessary, use Grade 5 capscrews of the same length as the original, with heads drilled for lockwire.

3. Prepare the engine block by cleaning and inspecting the flywheel housing mounting surface for flatness and freedom from damage. It will be helpful in later steps if the rear of the engine is elevated slightly, say 5° or so, so that longitudinal slack in the crankshaft bearings is taken up.

4. Mount the flywheel housing loosely in place with a few capscrews, centering it as well as may be by lining up dowel or bolt holes. Snug bolts enough to hold weight of housing without slipping.

RADIAL RUN-OUT

5. Mount the foot of the dial indicator support securely to the crankshaft and bring the spindle into position for proper contact against the machined

inner surface of the pilot bore for the clutch housing. (See Fig. 1.)

6. With felt tip marking pen, or the like, mark the top center, sides, and bottom 90° points around the housing, and measure and record the difference of opposite readings at these points.

7. With drift punch or small bar, pry the housing half the distance of the difference in horizontal and vertical directions until, with repeated measurement, as in Step 6, the difference falls within 0.000" to 0.004" total indicator reading.

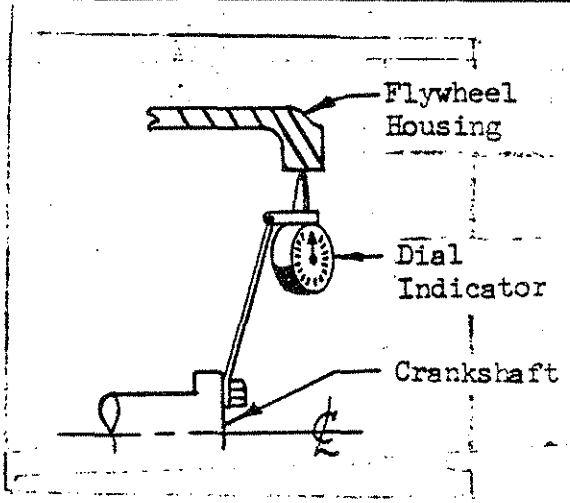


Fig. 1.

8. Put remaining mounting bolts in place, tighten moderately and recheck full 360° to be sure the 0.004" total indicator reading is not exceeded.

If excess run-out is found, repeat from Step 7.

When desired limit is attained, torque all bolts to values in Table II.

TABLE II

Bolt Size	Engine Mfr.	Torque (FT.-LB.)
9/16	GMC	150-160
5/8	CUMMINS	200-205

Recheck, and repeat from Step 7 if run-out limit is exceeded.

9. When radial run-out is brought within limits, and only then, mount the dowel jig under the pairs of capscrews adjacent to the dowel holes, drill and ream the dowel holes, and set the dowels. Replace and retorque the capscrews used to hold the dowel jig.

FACE DEVIATION

10. Next, reset the dial indicator bracket in position to read deviation of the face of the flywheel housing from a plane perpendicular to the crankshaft axis as the shaft is rotated. (See Fig. 2.) Note and record opposite paired differences at top and bottom, and at the two sides. By slightly tightening appropriate capscrews, bring the deviation within .008".

In case this tolerance cannot be attained, it may be necessary to change the flywheel housing (or rework it) and repeat the whole process.

11. Install lockwire through heads of capscrews.

FOR INSTALLING FLYWHEEL, SEE 01109

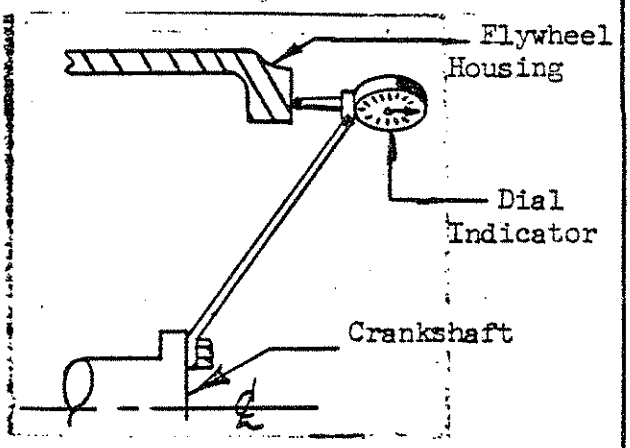


Fig. 2.

Compiled	F. FREER	SHOP PRACTICE TORQUING OF SCREW FASTENERS	33-01109
Approved			
Issued	9-4-87		
Revised		Chg Ltr **FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 1

SPECIAL VALUES: For the fasteners listed use the indicated Torque Values.

FASTENER	THREAD SIZE	GRADE BOLT MAT'L	TORQUE FT-LB	REMARKS
CAPSCREW, ENGINE LEG TO FLYWHEEL HSG. NTC SERIES ONLY	3/4-10 UNC	8	275-300	COAT CAPSCREWS WITH LOCKTITE (FL SPC 48-2110-1)
CAPSCREW, ENGINE LEG TO FLYWHEEL HSG. DDE ENGINES	5/8-11 UNC	5	137-147	

GENERAL VALUES: See 33-00109.

SPECIAL TORQUE VALUES (continued): For fasteners listed, use these torque values in preference to the general table. Values are for bolts as received with supplier's rust preventive (lubricating) coating.

	FASTENER	THREAD SIZE	GRADE MAT'L	TORQUE FT-LB	REMARKS
CAPSCREW, FLYWHEEL MTG.	DDE Engines	9/16 - 18 UNF	5	180-190	Tighten all to 48-52 ft-lb, then turn bolts an additional 90° - 120°. Use International compound #2.
	CAT Engines	9/16-12 UNC	8	110±15	
		3/4-10 UNC	8	265±35	
	CUMMINS K Series	5/8-18 UNF	8	245-264	
	CUMMINS L-10, NTC Series			190-200	
	CUMMINS FVT, VT Series			200-205	
*	Allen Head Cap Screw, Fan Clutch Mounting	3/8-16 UNC	8	45± 5	Apply Loctite (48-00094-141) to threads of socket head capscrew prior to installation
	Locknut, Fan Mtg.	5/16-24 UNF	8	18±5	
	Locknut, Alternator Mounting	7/16-14 UNC	8	55-65	Delco-Remy Alternators & Generators only
		1/2-13 UNC	8	80-90	
	NTC(c) Accessory Drive Pulley Nut			300-310	Cum/3012526 Flange Nut Cum/193136 Washer If removed, discard. Replace with new parts.
	Alternator Pulley				See 33-01122
	Rocker Cover DDE Die Cast	3/8" -16		15-20	12 point bolt head

Special Torque Values (cont.)

FASTENER	THREAD SIZE	GRADE	TORQUE FT-LB	REMARKS
DDE Starter Motors				
Aluminum Flywheel Housing	5/8" - 11		85-95	
Iron Flywheel Housing	5/8" - 11		137-147	

Compiled	BAROUDI	SHOP PRACTICE THROTTLE INSTALLATION AIR	33-01110
Approved	DLR		
Issued	3-8-68		
Revised	7-30-80	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	

For air throttle installation procedures, refer to the diagrams listed in the parts book or on the specification sheet.

COMPILED	MCINTOSH	SHOP PRACTICE ENGINE PREPARATION BREATHER VENT TUBES	SECTION NUMBER 33-01111
APPRV	JAKE		
ISSUE DATE	10/10/77		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-005 FOR ENGINE PREPARATION BREATHER VENT TUBES.

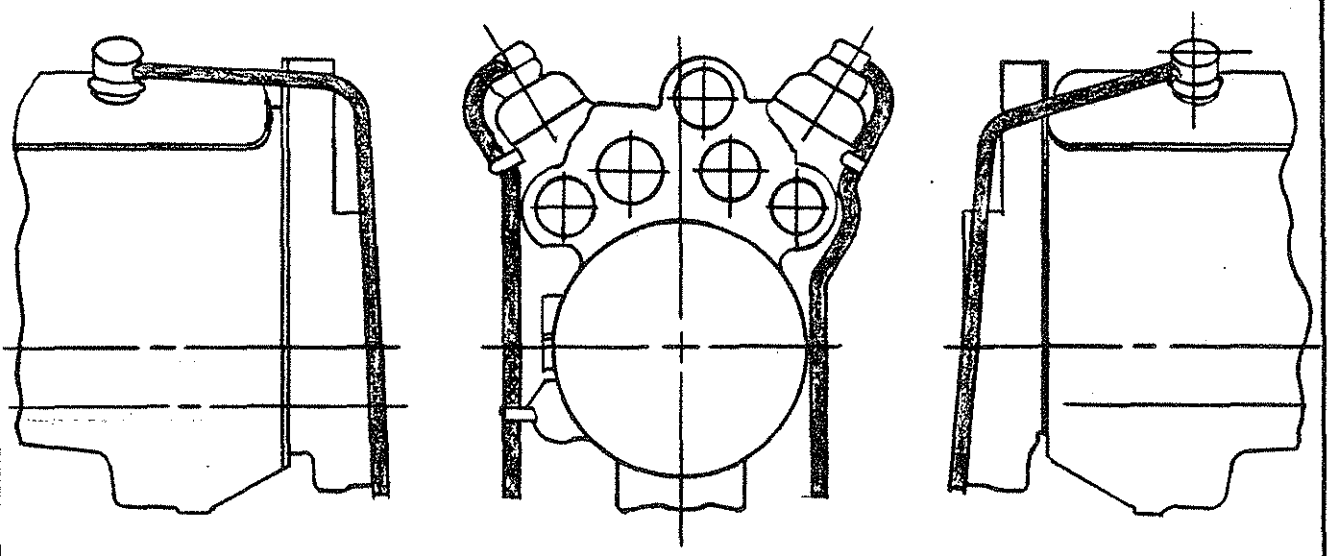
COMPILED	McINTOSH	SHOP PRACTICE ENGINE PREPARATION BREATHER VENT TUBES	33-01111
APPROVED	JAKE		
ISSUED	10-10-77	A FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1
REVISED	4-4-80		

A

A

A. DDE ENGINES:

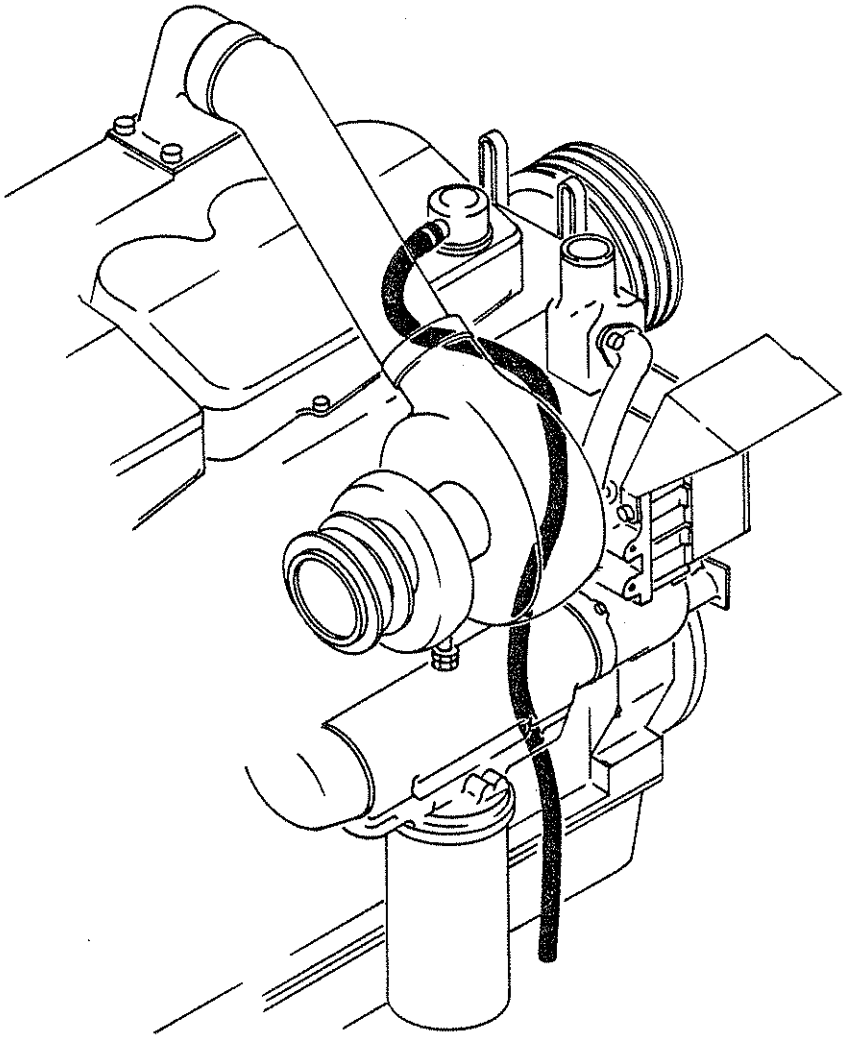
1. Clamp road draft tube(s) to valve cover breather(s) using a 23-9132-028 clamp.
2. Route tube(s) from valve cover breather(s) aft over valve cover(s), down back side of engine as shown below and support off transmission below rail.
3. Use sufficient number of tie downs to securely fasten hose(s) to engine.



NOTE: Road draft tube(s) called out in engine assemblies. They are required on all (DDE) V-type engines, one per breather.

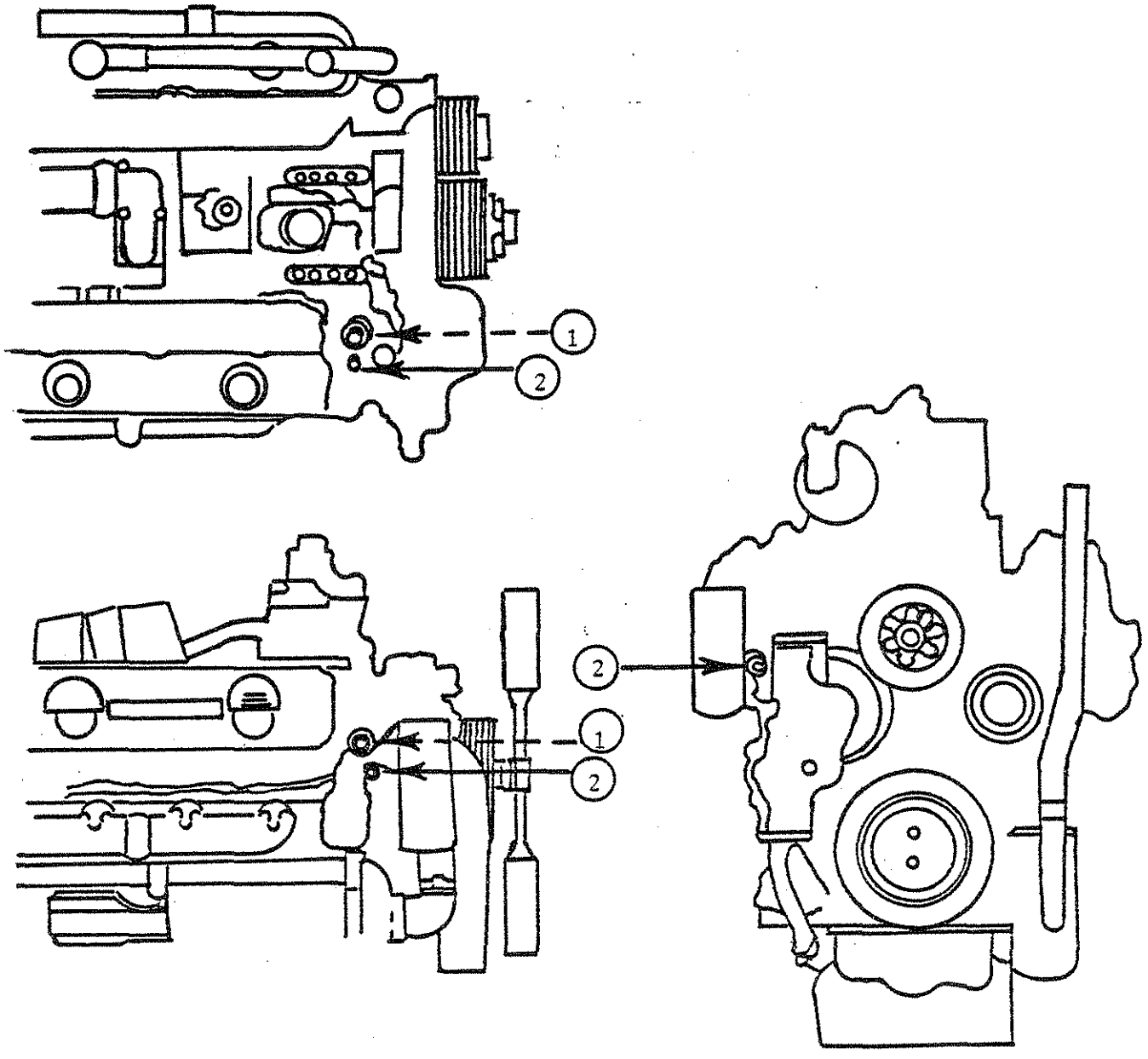
B. CATERPILLAR 3406 SERIES ENGINES WITH BRAKESAVER

1. Clamp tube (48-02246-125) to the valve cover breather using a 23-9132-028 clamp.
2. Route the tube from the valve cover breather over the valve cover and heat shield as shown below. Clamp as necessary.
3. Use a sufficient number of tie straps to fasten the tubing securely to the engine.



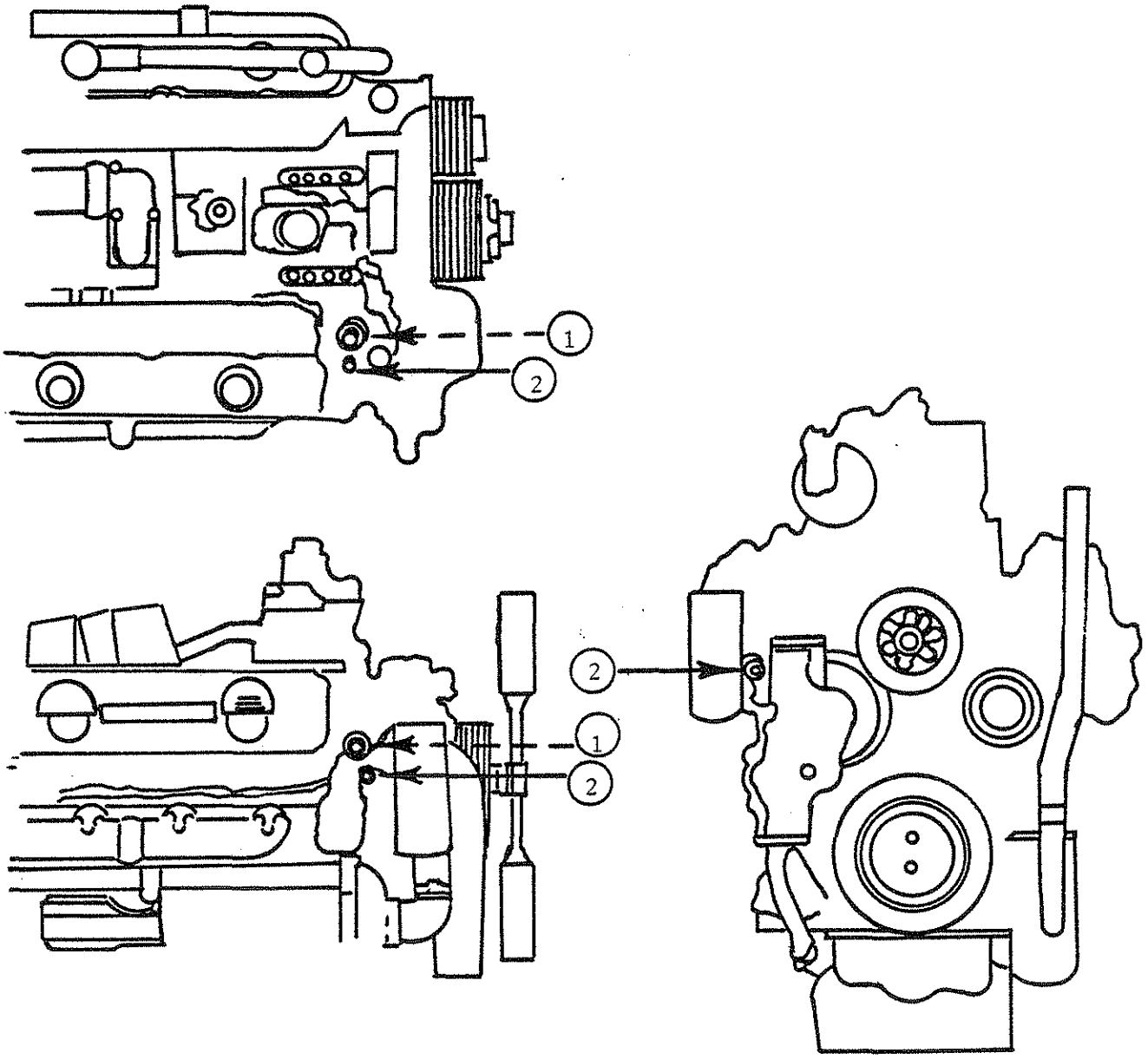
Compiled	Morrison	SHOP PRACTICE WATER TEMP. SENDING UNIT LOCATION CAT 3408 SERIES	33-01112
Approved	Morrison		
Issued	6-27-78	Chg Ltr	
Revised		**FREIGHTLINER CORPORATION** PORTLAND, OREGON	

The ½" pipe taps indicated as #1 below are not to be used for water temperature sensing probes that extend over 1 inch below the top surface of the cylinder head. In this location the probe will interfer with the operation of the thermostat. Alternate locations are indicated as #2.



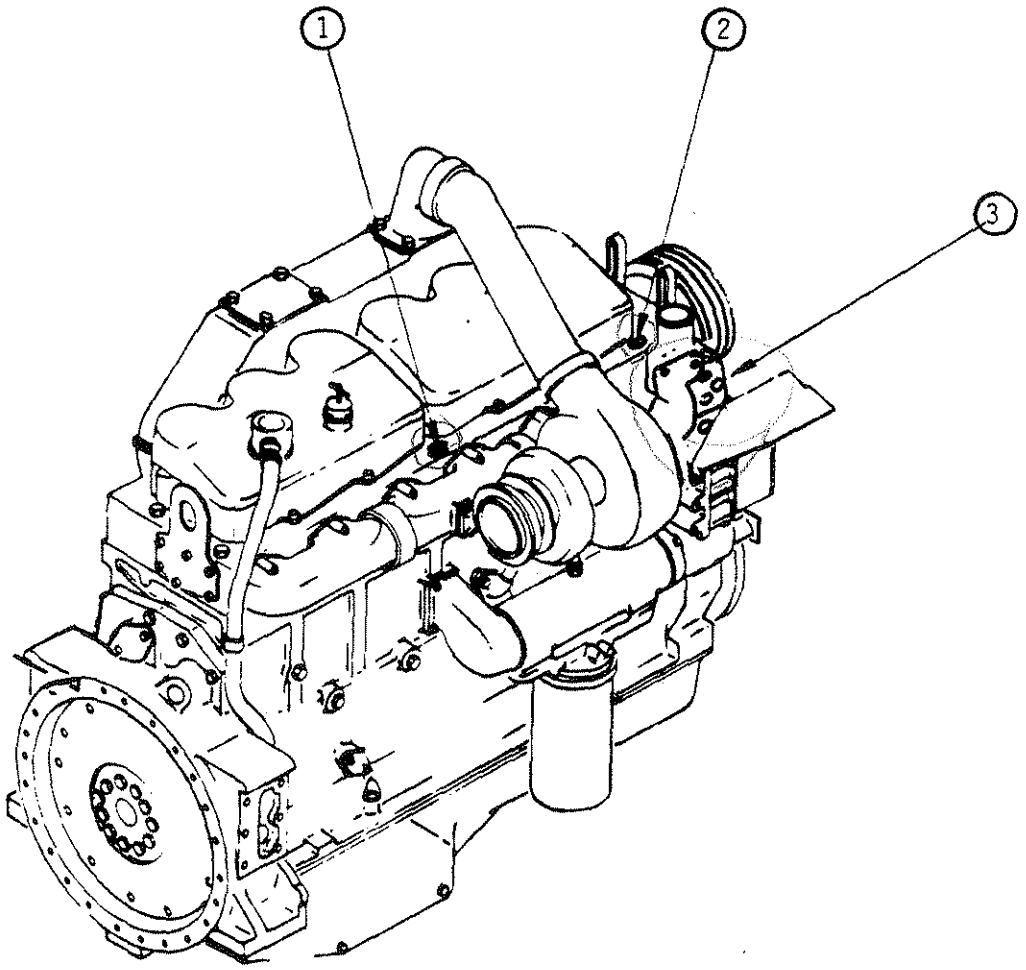
Compiled	Morrison	SHOP PRACTICE THERMAL SWITCH LOCATIONS CAT 3408 SERIES		33-01112
A Approved	Morrison			
Issued	6-27-78	Chg Ltr A	FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1
A Revised	7-20-79			

The ½" pipe taps indicated as #1 below are not to be used for water temperature sensing probes that extend over 1 inch below the top surface of the cylinder head. In this location the probe will interfer with the operation of the thermostat. Alternate locations are indicated as #2.



Compiled	S. HEILESON	SHOP PRACTICE THERMAL SWITCH LOCATIONS CAT 3406B SERIES	33-01112
Approved			
Issued	7-20-79		
Revised	6-7-81	Chg Ltr E FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 2

E-Y



- Use ports (1) & (2) for temperature gauge and high temp warning sensor.
- Replace high temp sensor with any alarmstat or high temperature shutdown actuator (when requested).
- Replace high temp/temperature gauge sensor with fan control/shutterstat sensor (when requested) and relocate high temp/temperature sensor in any of 5 available ports in thermostat housing. (3) (Use these ports as required whenever any other sensor device is installed.)

COMPILED	F F
APPRV	S P
ISSUE DATE	10/30/81
REV DATE	07/29/96
CHG LTR	A

SHOP PRACTICE

FLYWHEEL REMOVAL & INSTALLATION CUMMINS ENGINES

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-01114

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-006 FOR FLYWHEEL REMOVAL/INSTALLATION CUMMINS ENGINE.

Compiled	F. Freer	SHOP PRACTICE FLYWHEEL REMOVAL & INSTALLATION CUMMINS ENGINES	33-01114
Approved			
Issued	10-30-81		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

REMOVAL

1. Remove two flywheel mounting capscrews on opposite sides of the flywheel.

2. Install two threaded guide pins in the two holes in the crankshaft to provide support for the flywheel during removal. Guide pins should be six inches long with the proper threads on one end.

   VT-255-Series, 9/16" - 18
   All Others, 5/8" - 18

3. Remove remaining mounting capscrews.

4. In the holes provided, install two 3/8" - 16 or 1/2" -13 capscrews, threaded their entire length, to act as jackscrews. Turn in capscrews alternately to pull flywheel from crankshaft.

INSTALLATION

1. Clean flywheel and crankshaft mating surfaces.

2. Install two guide pins (as described in Step 2 above) in two opposite holes in crankshaft flange. Install flywheel on crankshaft.

3. Install four flywheel mounting capscrews with P.N. 200861 hardened flatwashers; tighten alternately until snug. Remove guide pins and install remaining two mounting capscrews and washers.

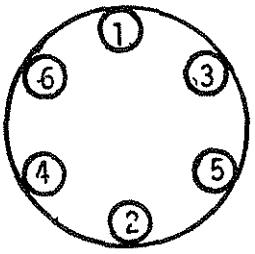
   NOTE: Lightly lubricate capscrew threads and washers.

4. Tighten mounting capscrews to the valve and in the sequence shown below.

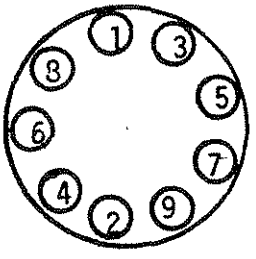
5. Repeat tightening sequence; tighten to a final torque as shown below.

6. Check clutch pilot bearing bore with a dial indicator. Total reading must not exceed 0.005 inch in one complete revolution.

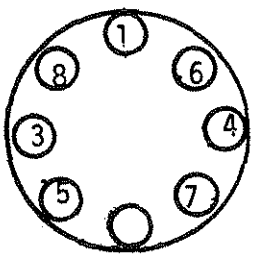
7. Check flywheel clutch face with a dial indicator. Total reading must not exceed 0.0005 inch per inch of clutch diameter. Crankshaft end thrust must remain at one point during check.



"NTC"SERIES



"K" SERIES



"VT" SERIES

COMPILED	ERK	SHOP PRACTICE BY-PASS OIL FILTER	SECTION NUMBER 33-01115
APPRV	DWR		
ISSUE DATE	06/22/70		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	F		PA2042-72

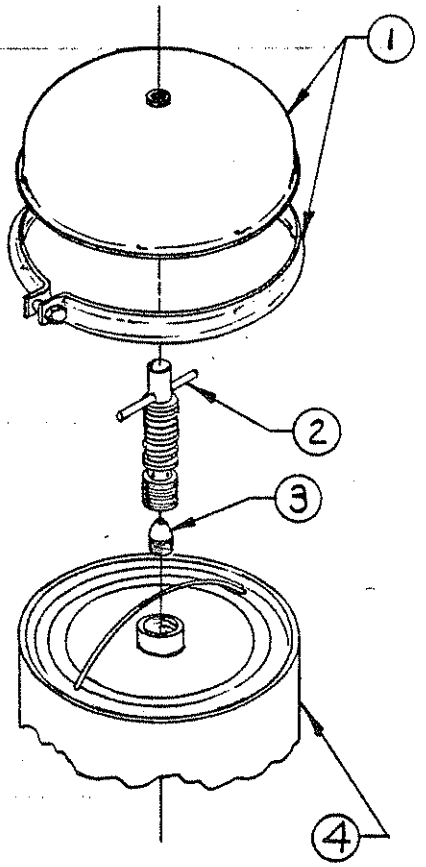
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-007 FOR ENGINE OIL BY-PASS FILTER.

Compiled	SCB	SHOP PRACTICE	33-01115
Approved	BRAY	BY-PASS OIL FILTER	
Issued	6-22-70		
Revised	6-23-80	Chg Ltr D	Page 1

FREIGHTLINER CORPORATION
PORTLAND, OREGON

LUBERFINER 750-C

The Luberfiner 750-C by-pass oil filter (Ref. LBF #3250) is received with a 0.125 inch diameter orifice (Ref. LBF #2159-8). When the engine in the vehicle requires a different orifice (see chart below), follow this procedure:



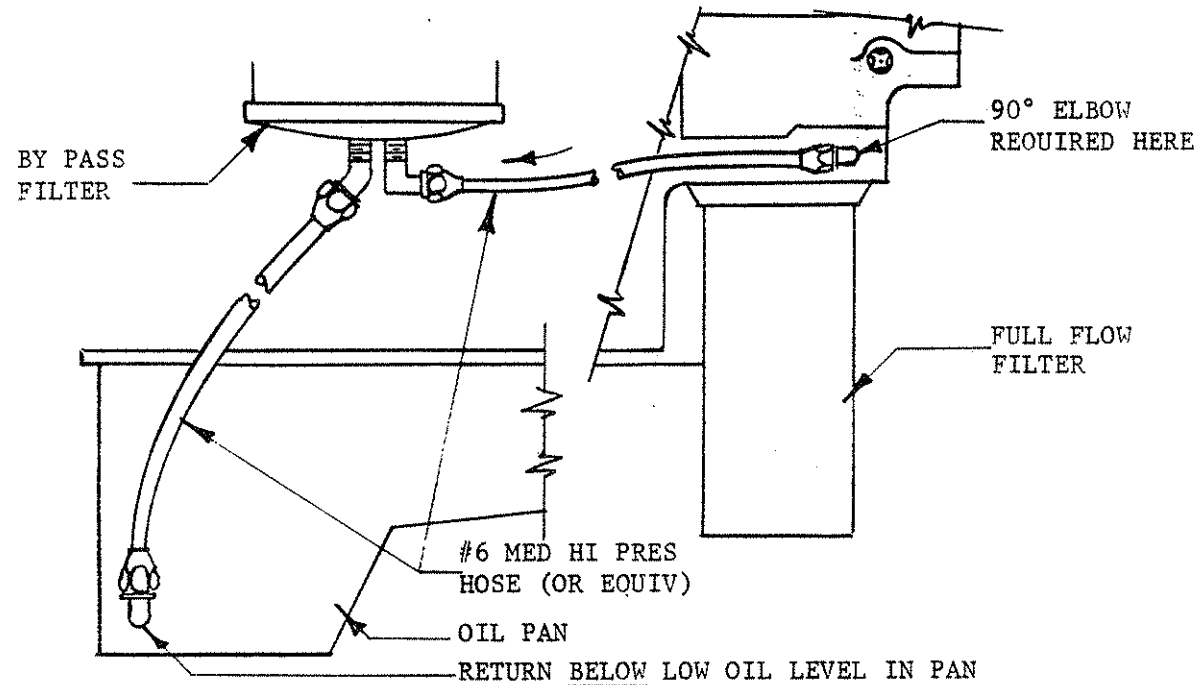
To Change Orifice:

1. Remove securing ring and top cover (1) .
2. Unscrew the T-bar handle assembly (2) and remove it from the filter body (4) .
3. Unscrew the orifice (3) from the bottom of the T-bar handle assembly and replace it with the required orifice (see chart below).
4. Screw T-bar handle assembly (2) back in place in the filter body (4) .
5. Replace cover and securing ring (1) .

ENGINE		ORIFICE		
MAKE	MODEL	LBF PART NO.	DIA. (IN.)	FLOW RATE (GAL/MIN)
CAT	ALL*	2159-8	0.125	2.2
CUM	ALL*	2159-8	0.125	2.2
DDE	12V-71*	2159-8	0.125	2.2
	8V-71	2159-6	0.101	1.6
	6171	2159-62	0.062	0.5
	8V-92 Series 6V-92 Series	2159-6	0.101	1.6

* NO CHANGE REQUIRED

Compiled	MENGES	SHOP PRACTICE BY-PASS OIL FILTER	33-01115
Approved	BRAY		
Issued	7-31-72		
Revised	4-4-80	Chg Ltr A **FREIGHTLINER CORPORATION** PORTLAND, OREGON	PAGE 2



BYPASS OIL FILTERS ON CUMMINS ENGINES

CUMMINS ENGINE MODEL	CONNECT #6 MED. HI PRESSURE FLEX HOSE ASSEMBLY	
	FROM	TO
VT SERIES	1/8-27 NPTF pressure tap in the side of the head of full flow oil filter. (See diagram.)	Inlet port of the bypass oil filter.
NTC-Series	3/8-18 NPTF Pressure tap in outboard side of the lube pump housing.	

CAUTION: Do not connect to the gear cover on any of these engines since this could result in an insufficient oil supply to the drive gears in this area.

A Revised & Redrawn

REPORT ERRORS AND CHANGES TO CORPORATE ENGINEERING

OIL FILTER: CENTRIFUGAL

1. Filter must be mounted vertically (with a 5^{o} maximum tolerance to insure relatively even bearing loading) and above the crankcase oil level.

2. Provide an unrestricted gravity return line for the filtered oil. The oil return line should be as short and straight as possible. No 90^{o} Ells. Return connection must be above oil level in pan.

3. Connect the filter supply line between the oil pump and the engine gallery (as close as possible to the oil pump).

4. Use 1.25 O.D. (No. 16) hose for oil return line.

5. Use .75 O.D. (No. 8) hose for oil supply line.

COMPILED	T D	SHOP PRACTICE	SECTION NUMBER
APPRV	DCR	STARTER INSTALLATION, AIR	33-01116
ISSUE DATE	05/24/71		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	D		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-008 FOR ENGINE AIR START INSTALLATION.

A. PIPING FOR AIR STARTERS, GENERAL

Use, as shown below, pipe and fittings for air starter motor supply lines.

AIR STARTER	HOSE LENGTH	MINIMUM HOSE SIZE	MINIMUM PIPE & FITTING ID
Ingersoll Rand 150 BM Series	All	No. 20	1.0"
Startmaster	Under 6 ft.	No. 16	.8"
SM 250 Series	Over 6ft.	No. 20	1.0"

Keep supply lines as short as possible.

Use a minimum of bends in the supply line and use large radius bends instead of sharp ones wherever possible.

NOTE: Start Master starters only, use (SDH) 19227 sealant kit on all fittings in the air starter system. Since this is a requirement of Start Master, do not use teflon tape.

B. STARTMASTER STARTERS

When installing the fittings on a Startmaster motor, the following procedure is to be used:

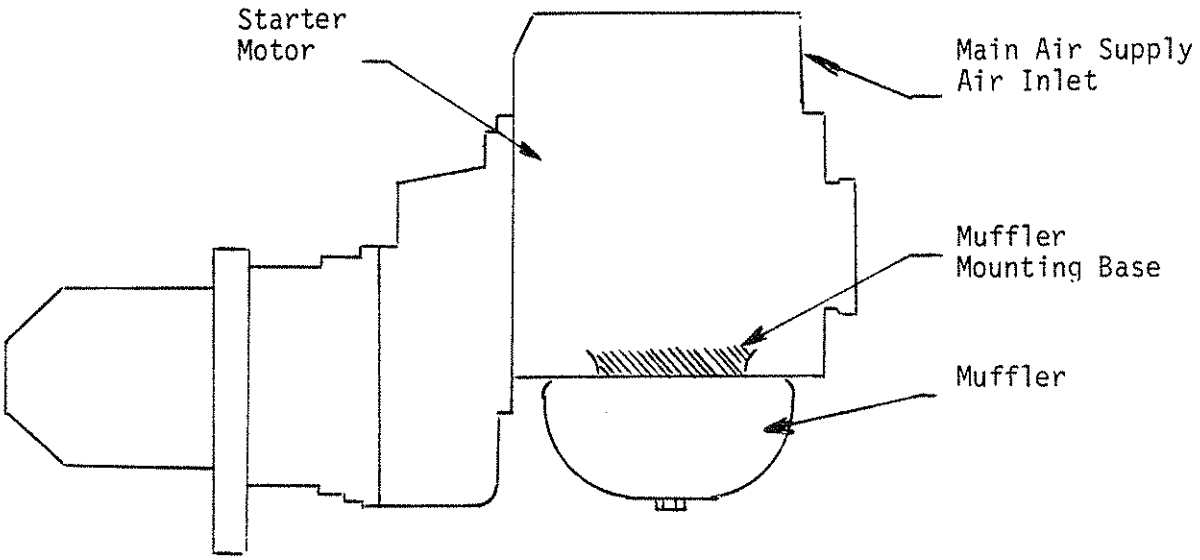
1. Remove the muffler.
2. Position the muffler mounting base in a vise.
3. Install fittings and adapters using the SDH/19227 sealant kit on all fittings. Teflon tape is not acceptable.

CAUTION: DO NOT GRASP THE MOTOR CASE IN THE VISE AS IT IS EASILY CRUSHED.

C

REVISED & RETYPED "A" CHG.

STARTMASTER STARTERS



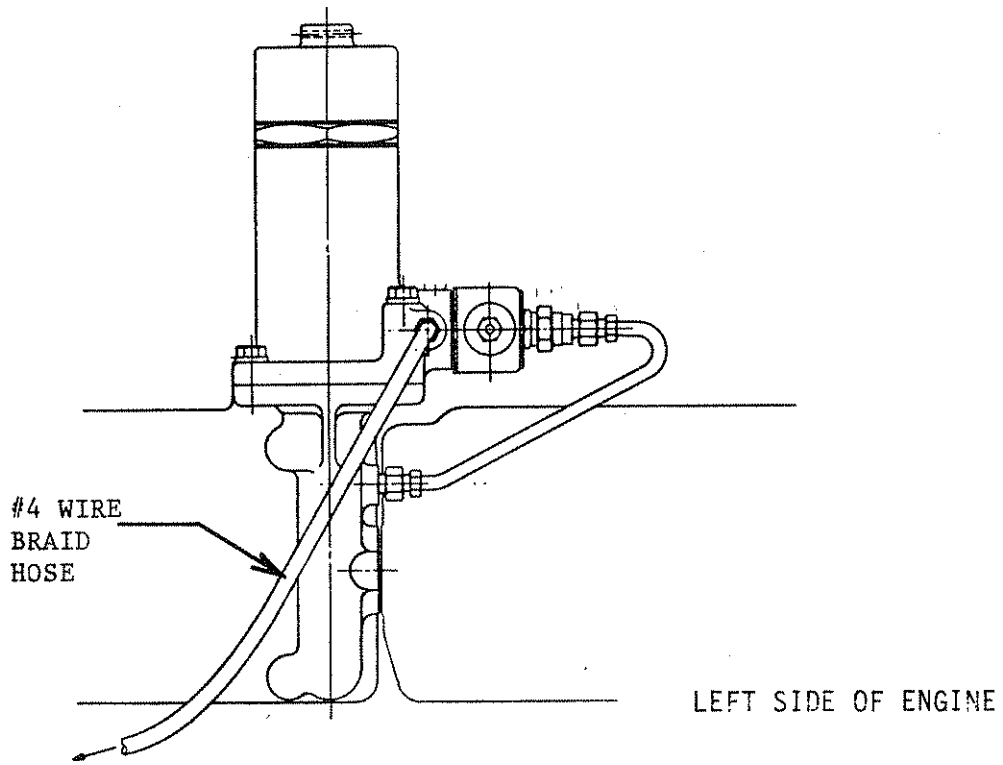
NOTE: Main air supply fittings must be installed in the manner described above in order to prevent misalignment of the seals and/or drive housing damage.

Compiled	S. HEILESON	SHOP PRACTICE MVT GOVERNOR PLUMBING	33-01117
Approved	T. DUNLAP		
Issued	5-11-82		
Revised	9-4-87	Chg Ltr E FREIGHTLINER CORPORATION PORTLAND, OREGON	

MVT (MECHANICAL VARIABLE TIMING) AIR PLUMBING

The following engines will require plumbing as shown:

1. All Cummins NTCC Series engines.
2. All Cummins NTC-475 & F-450 engines.



COE

E To pressure protection valve located on secondary reservoir.

CONVENTIONAL

E To pressure protection valve located on secondary reservoir.

E

1. INSTALLATION & ADJUSTMENTS are to be made as per Jacobs instructions noting the following:

   CATERPILLAR 3406 ENGINE requires installation of an Internal Fuel Pump Switch replacing the Low Idle Screw. The procedure is:

   A. Remove the Caterpillar Low Idle Screw and Locknut and Discard.

   B. Replace with Internal Fuel Pump Switch JB/008920), Hex Jam Nut (JB/001713) and Compression seal (JB/012290).

   C. Reset the Low Idle RPM as follows:

      The following is Caterpillar's procedure for Low Idle RMP adjustment taken from Systems Operation Testing and Adjustment 3406 Diesel Truck Engine Reg. 01411-02.

      1. Turn the Jacobs Internal Fuel Pump Switch as necessary to change Low Idle RPM.

      2. After an idle adjustment is made, move the governor lever to change the RPM of the engine.

      3. Now move the governor lever back to the point of first adjustment. Use this procedure until the RPM is the same as the RPM specification given in the Caterpillar Rack Setting Information Book.

      4. Tighten the lock-nut to maintain the proper switch position. Attach the Jacobs wiring harness to the Internal Pump Switch Terminals.

         CAUTION:

         The Jacobs Internal Fuel Pump Switch is for negative ground vehicles only. The diode position is not changeable on this switch.

MOUNTING OF FORWARD AIR CLEANER SUPPORT BRACKET

Install forward support bracket (Ref: 03-15338-0) as the following:

1. Insert the two (2) 8 5/8 in. long studs JB/2856 (Kit JB/2879) in the housing normally used with the rear lifting eye bracket, and use the two (2) JB/1232 studs for the forward fan bracket support.

2. Locate the rear valve cover with the breather tube in the center.

3. Set the two (2) 23-10681-500 spacers on top of the two (2) JB/1234 spacers, place the forward bracket 03-15338-0, the lifting eye bracket and tighten the two nuts. (For ref. see Diagram D03-15333.)

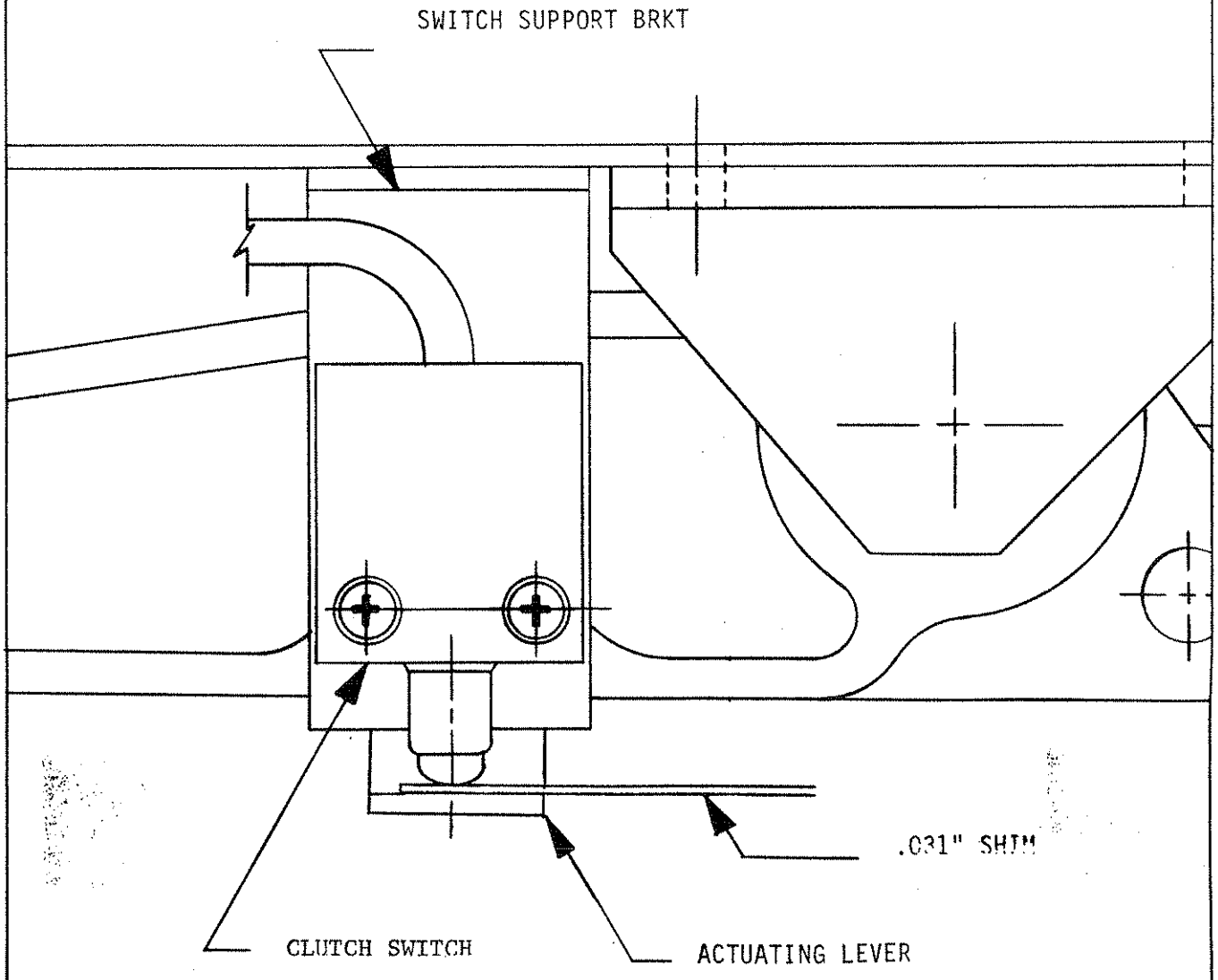
Compiled	McINTOSH	SHOP PRACTICE CRUISE CONTROL CLUTCH SWITCH ADJUSTMENT UNDERDECK	33-01118
Approved	LOUTZENHISER		
Issued	9-16-85		
Revised	11-18-86 Chg Ltr A	FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 3

A

A

CLUTCH SWITCH INSTALLATION AND ADJUSTMENT

Fasten switch support bracket and actuating lever per D22-29512. Mount the switch to the support bracket leaving the fasteners loose. Insert a .031" thick shim between the switch & the actuating lever, as shown below. Depress the switch to is full travel against the shim & tighten the switch mounting fasteners. Remove the shim.

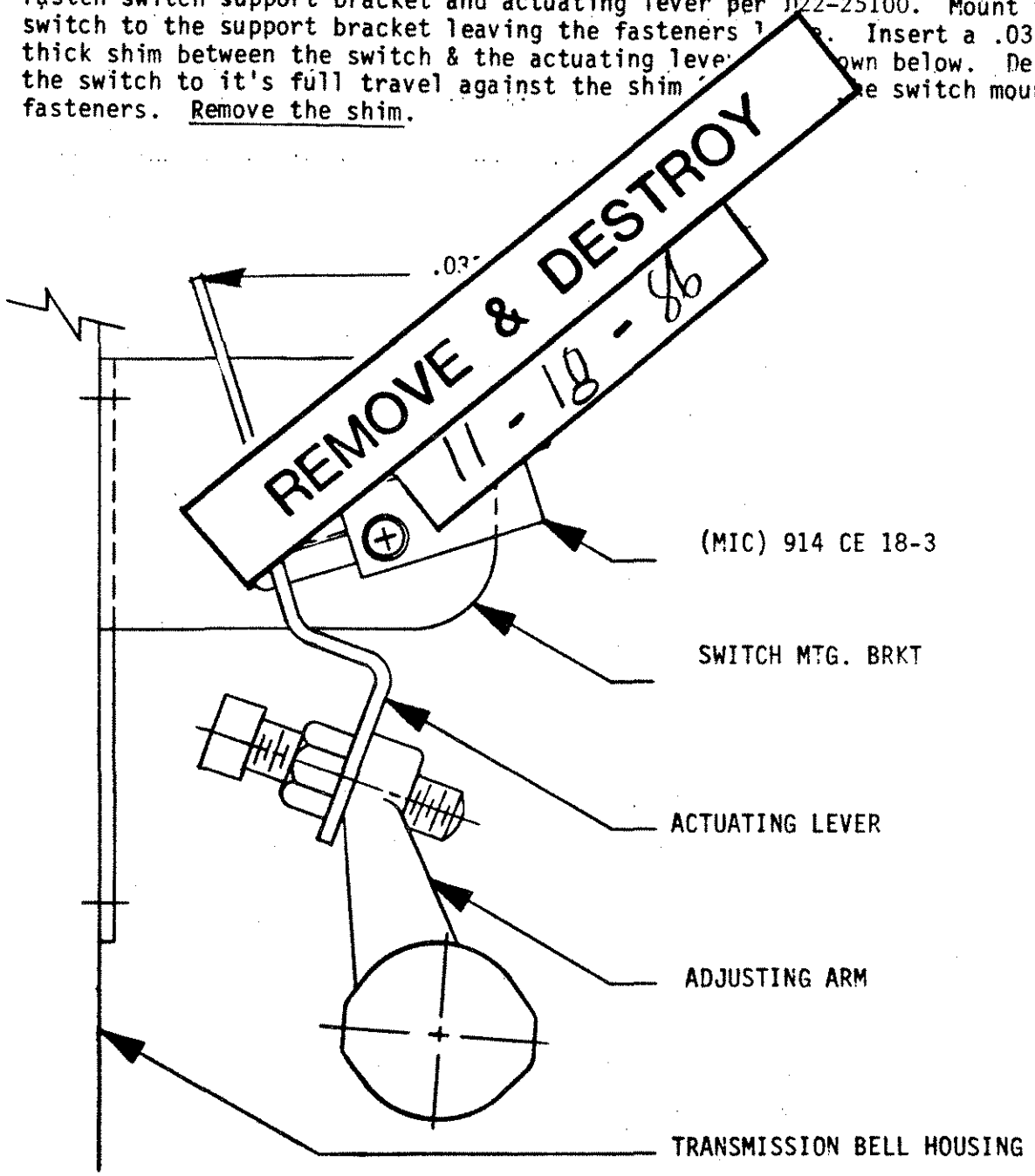


B

(MIC) 914 CE 18-3 INSTALLATION AND ADJUSTMENT

Fasten actuating lever to adjusting arm using existing hardware per D22-25100. Allow a slide by clearance of .094 ± .031 between switch mounting bracket and actuating lever.

Fasten switch support bracket and actuating lever per D22-25100. Mount the switch to the support bracket leaving the fasteners l[illegible]. Insert a .031" thick shim between the switch & the actuating leve[illegible]own below. Depress the switch to it's full travel against the shim [illegible]e switch mounting fasteners. Remove the shim.



Compiled	L. MURRELL	SHOP PRACTICE TURBOCONVEYOR WARNING	33-01120
Approved	Ruuhela		
Issued	4-11-79		
Revised	6-23-80	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	

A The Schwitzer Turboconveyor kit includes a warning decal, CUM/3019367. This label is to be placed in plain view on the drivers side of the dash as close to the pyrometer as possible.

COMPILED	F F	SHOP PRACTICE ENGINE ACCESORY DRIVES CUMMINS	SECTION NUMBER 33-01121
APPRV	L M		
ISSUE DATE	04/04/80		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-009 FOR CUMMINS ENGINE ACCESORY DRIVES PROCEDURE.

Compiled	F. Freer	SHOP PRACTICE ACCESSORY DRIVES, CUMMINS	33-01121
Approved	L M		
Issued	4-4-80		
Revised		Chg Ltr	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

NTC SERIES ENGINES

If the accessory drive pulley is removed, the nut and washer are to be discarded. Upon reinstallation of the pulley, a new nut and washer are to be installed and torqued per 33-01109.

COMPILED	F F	SHOP PRACTICE ALTERNATOR PULLY MT. GUIDELINES	SECTION NUMBER 33-01122
APPRV	L M		
ISSUE DATE	04/04/80		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-010 FOR ALTERNATOR PULLY MT. GUIDELINES.

1. PULLEY MOUNTING ON ALTERNATOR

A. Initial placement of the pulley on the alternator shaft must be by hand or by steady mechanical or hydraulic pressure. Do not use hammering action under any circumstances.

B. Run-up of pulley: It is permissible to use an impact wrench to run the retaining nut on until the pulley is just snug on the shaft.

C. Final Tightening: Shall be by hand to the torque shown in the following table:

Caution: If rotor is held in a vise for this operation, be careful not to tighten the jaws excessively or damage to the rotor may result.

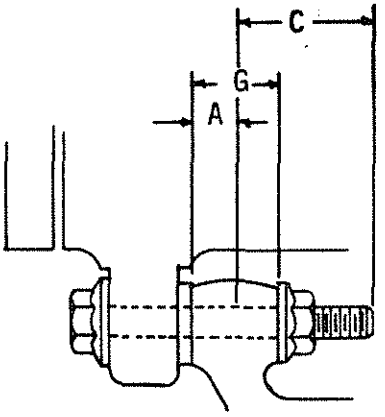
A

MANUFACTURER	SYMBOL	CURRENT RATING (Amperes)	TORQUE VALUE (Ft. - Lb.)
Leece-Neville	LN	ALL	70 - 80
Motorola	MOT	ALL	40 - 50
Delco-Remy	DR	62	53 - 62
		75	70 - 80
Neihoff	NEH	60	40 - 50
		85,100	70 - 80

A

2. BOLTS

Bolts used in attaching the alternator to the bracket are to have as few threads internally within the bracket and alternator as possible, therefore, a bolt may be chosen which exceeds the allowable protrusion beyond the nut. A maximum of 50% of the bracket area may have threads in it. Reference: Sketch on right. Use bolts specified in parts book.



A Minimum - 50% of B
C = Bolt Thread Area

NOTE: ABSOLUTELY NO LOCKWASHERS ARE TO BE USED ON ANY ALTERNATOR OR MOUNTING COMPONENTS.

NOTE: Do not install hardened washers between bolt head and adjusting link, and between adjusting link Delco Remy 62 AMP alternator on DDE 8V-92 Series.

3. POWER STEERING PUMP AND ALTERNATOR BELT

The installations which utilize the same belt or belts to drive the power steering pump and alternator use the following steps for adjustment:

This sequence of adjustment is to assure a more positive drive for steering pump operation.

1. Back off alternator adjustment.
2. Adjust power steering pump until belt is snug. Use matched belts if two belt drive setup.
3. Adjust alternator to tighten belt to proper tension, as per 33-01101.

5. DR 32SI Flange Mount Alternator

...

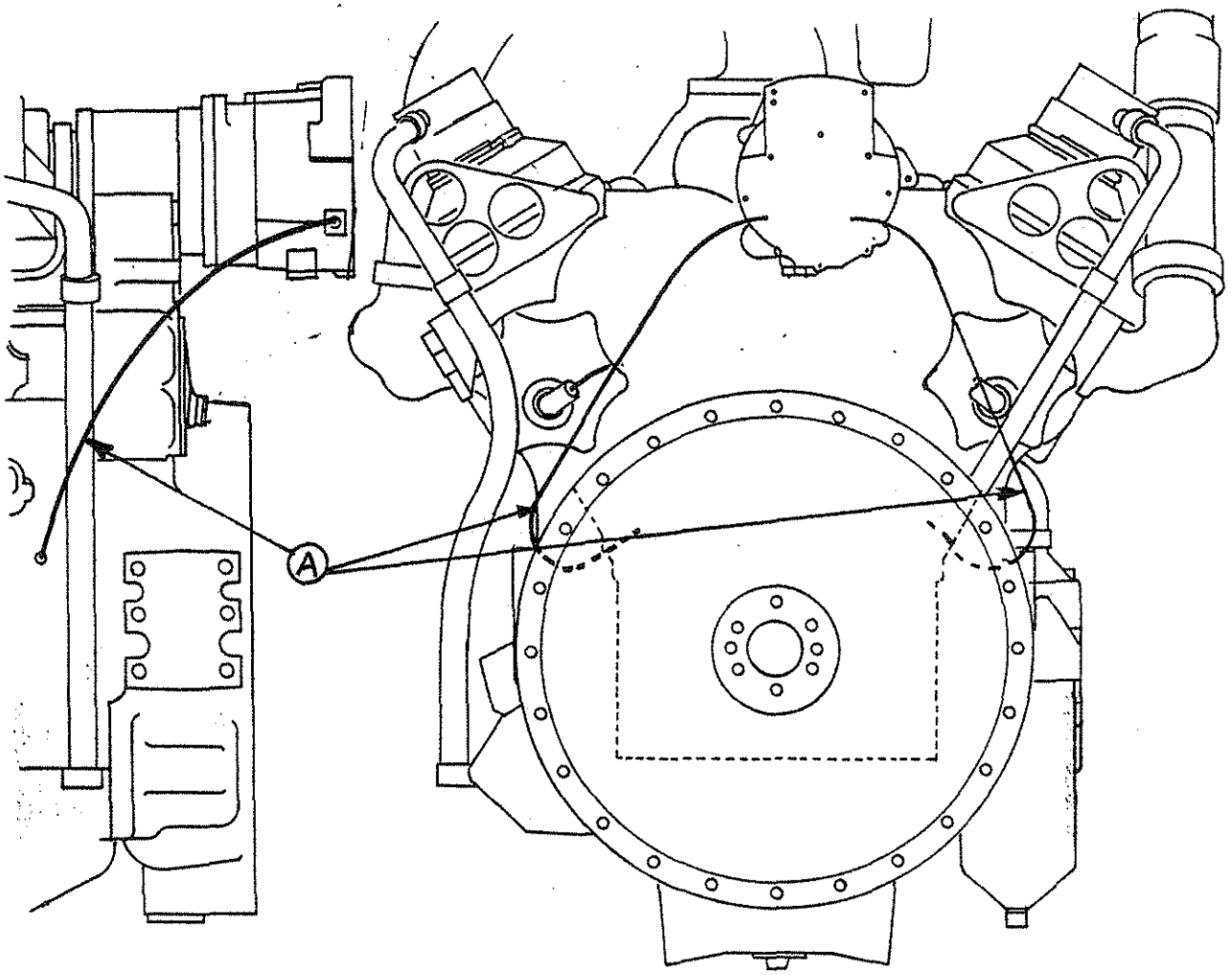
A. Supply Line must come from the engine block on the side opposite the turbo oil supply line without exception.

- Use single braid hose with an 1/8" N.P.T.F. fitting at the alternator end.

A

B. Inst. Diagram should be consulted (ref. D01-14160)

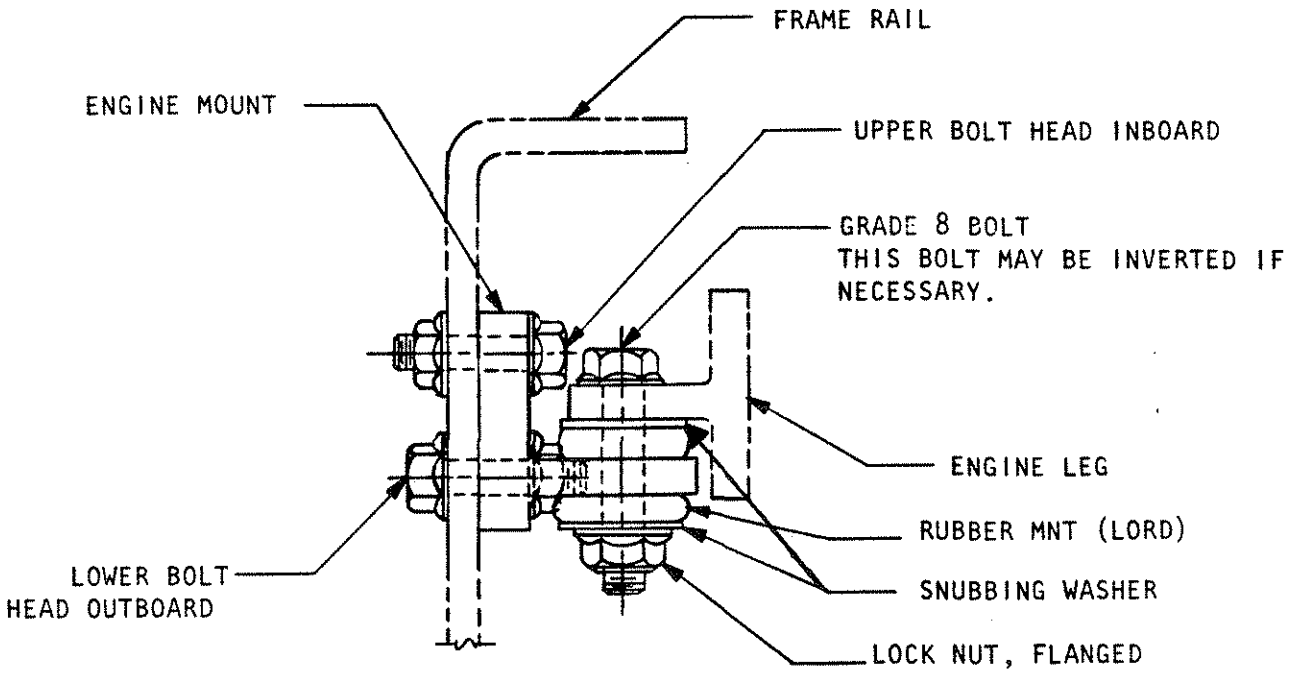
A



D

A. ENGINE REAR SUPPORT INSTALLATION

1. Typical installation for isolation type engine mounting:

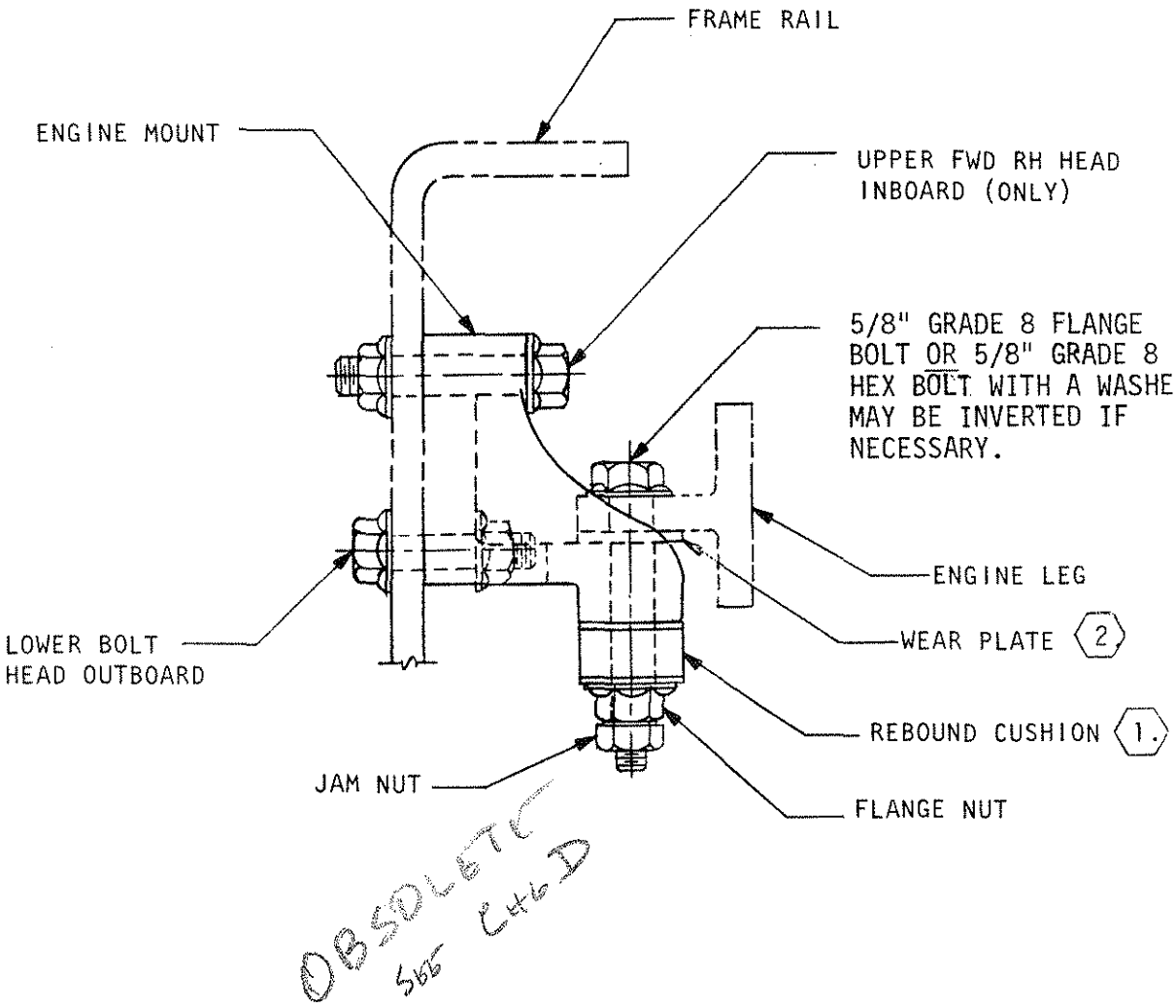


CAUTION: For inserting rubber mount, use only soapy water or special preparation as for mounting rubber tires. Under no circumstances are oils, grease or silicone lubricants to be used.

A

A. ENGINE REAR SUPPORT INSTALLATION

1. Typical installation for rebound cushion type mounting:



OBSOLETE SEE C46D

(1.) Install nut finger tight, then tighten nut 1½ turns (compressing rebound cushion to height of 1.31 in.) Use an additional nut, as jam nut, torqued to 170-185ft-lbs.

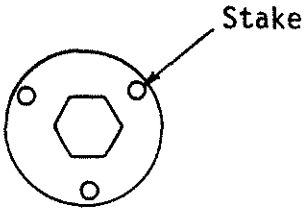
(2.) DDE 12V-71 IN COE:

This installation requires use of three(3) wear plates installed as follows:

LH - 1 plate
RH - 2 plates

B 2. COUNTERSUNK BOLTS

When engine rear supports are mounted directly to pads on the flywheel housing with flat head (countersunk) bolts, it is necessary to stake the edges of the heads of the bolts at 3 equally spaced intervals. Use a large center punch and stake to a minimum of .06 depth of indentation.



B 3. REAR LEG

A. DDE 6L71N SERIES

1. Use Grade 5, 1/2-13 UNC x 1.50 capscrews.

2. Use 1/2 spring-type lockwasher under bolt head.

3. Torque per list of values on 33-01109.

B. 6V92 & 8V92, 8V71N SERIES

1. Use 23-9474-200 capscrew 5/8-11 UNC x 2.00 and 23-10361-62 tab, lockwasher.

2. Coat capscrew with Locktite per Spec 48-02110-001 and torque per list of values on 33-00109.

C. CUMMINS & CAT ENGINES

Caterpillar and Cummins engines either have rear legs cast integral with the flywheel housing, or they are bolted on normally without special capscrew locking provision.

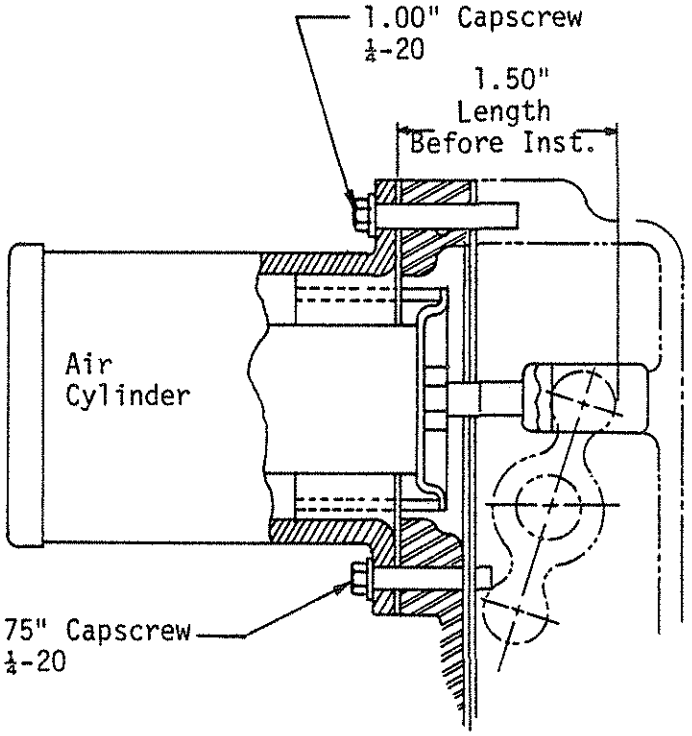
Compiled	F. FREER	SHOP PRACTICE RETARDER CONTROLS	33-01124
Approved	SJH		
Issued	2-6-85		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

CUSTOMER FURNISHED RETARDERS

When switches and wiring is provided for later installation of a retarder, such as Jacobs brake, the switches are not to be installed in the dash. They are to be tagged and placed in the glove box.

Compiled	F. Freer	SHOP PRACTICE AIR SHUT DOWN	33-01125
Approved	L M		
Issued	4-4-80		
Revised		Chg Ltr	FREIGHTLINER CORPORATION PORTLAND, OREGON

AIR SHUT DOWN INSTALLATION ON CAT 3408



Compiled	S. HEILESON	SHOP PRACTICE AIR COMPRESSOR	33-01126
Approved	T. DUNLAP		
Issued	6-7-85		
Revised	12-10-85	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

A. BW AIR COMPRESSOR INTAKE CONNECTIONS

ENGINE	COMPRESSOR CAPACITY IN CFM	COMPRESSOR AIR SUPPLY FROM:
CAPEPILLAR 3406B SERIES	12,15.5	ENGINE INTAKE MANIFOLD
CUMMINS ALL MODELS EXCEPT MODELS BELOW	12	ENGINE INTAKE MANIFOLD
PT/NTC-270 NTCC-400 NTC-450/475		BETWEEN TURBOCHARGER AND AIR CLEANER
ALL	15	BETWEEN TURBOCHARGER AND AIR CLEANER
DDE 6V92 SERIES 8V92 SERIES	12,15.5	ENGINE AIR INLET HOUSING
6L71 SERIES	12	AIR INTAKE GALLEY ON LH SIDE OF ENGINE

B. CUMMINS ENGINE WITH BW COMPRESSOR: When a Cummins compressor is removed and replaced with a BW UNIT, the lower accessory drive housing oil hole is not to be plugged.

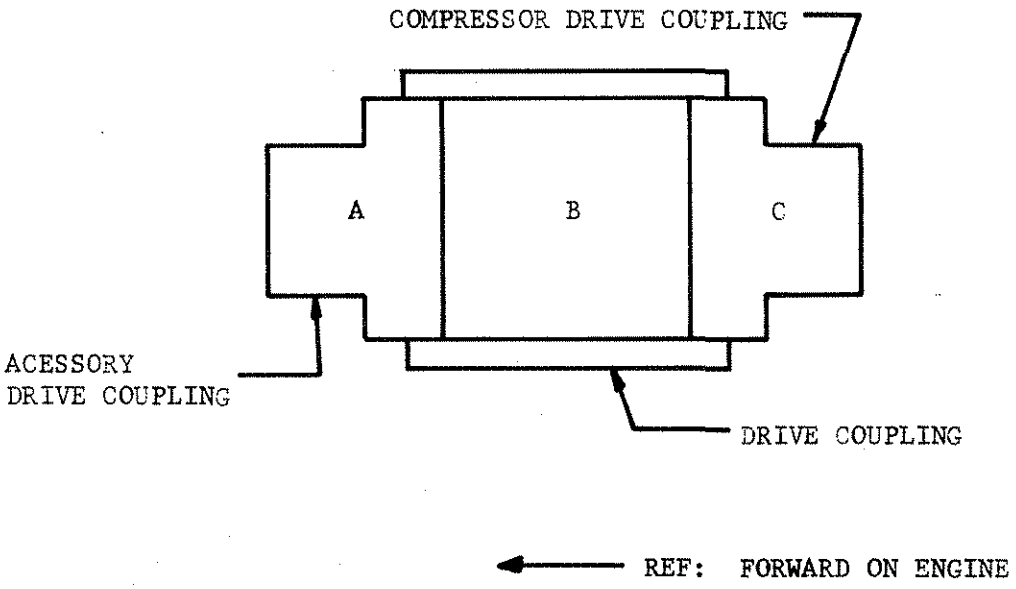
C. DDE ENGINES WITH BW COMPRESSOR: When installing the compressor, the Marsden lock nut is to be torqued to 120 Ft/Lbs. A cotter pin is not to be installed in the crankshaft hole.

D. BW TU-FLO 700 (15.5 CFM) COMPRESSOR: Coolant lines are to run in one of the block ports and out one of the head ports. Do not run in and out of the head ports. Exception: Caterpillar 3406 where coolant water flow is acceptable through opposite end head ports.

D. Air Compressor Installation on Cummins Inlines

It is absolutely necessary that the proper coupling combinations be used on compressor installations made on Cummins inline engines. Use chart below; NO EXCEPTIONS!

Compressor Model	A	B	C
CUM 13.2 Cu. Ft.	190769	199349	190769
BW TU-FLO 501 12 Cu. Ft.	190769	199358	200398
BW TU-FLO 700 15,5 Cu. Ft.	190769	200824	200398



E. Air Compressor Oil Drain, Belt Driven Compressor, on Detroit Diesel

The oil drain line must be free of restrictions and bends which have a radii of less than 2". It must also have a minimum downward flow of 2" per foot and must be free of traps. The drain line must enter the engine at a point above the engine oil level. The oil drain line must provide adequate draining to insure that the air compressor connecting rods do not dip in oil.

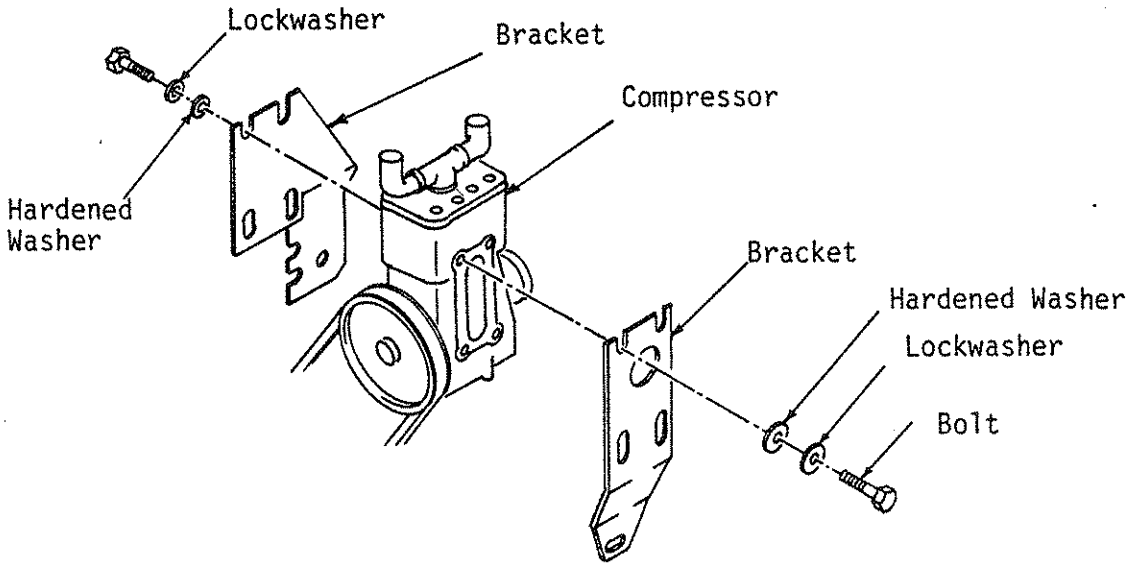
Compiled	F. Freer	SHOP PRACTICE FREON COMPRESSOR	33-01127
Approved	LM		
Issued	4-4-80		
Revised		Chg Ltr	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

FREON COMPRESSOR MOUNTING

Use hardened washers between mounting bolt and freon compressor when fastening compressor to engine.

MOUNTING FOR CUMMINS INLINE ENGINES SHOWN: mountings on other engines; use hardened washers in a similar way.

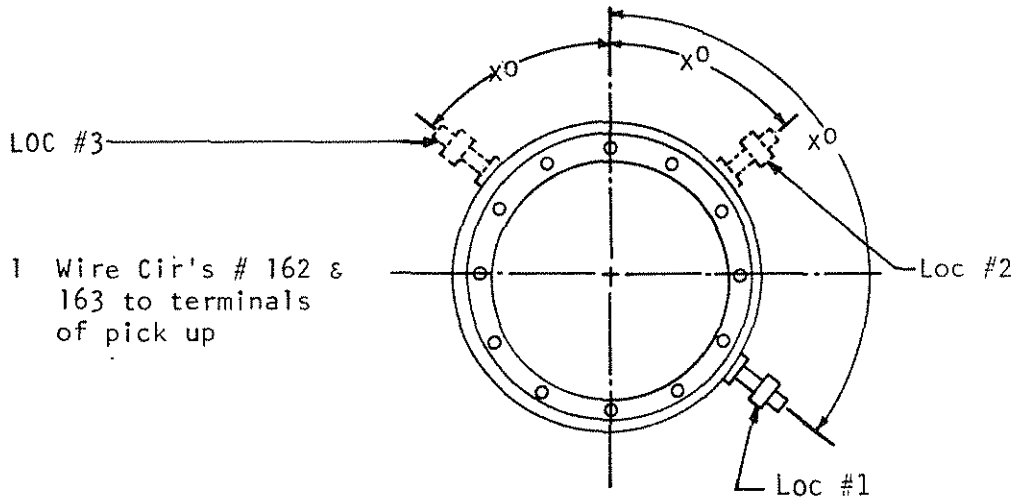


Compiled	T. Young	SHOP PRACTICE TACHOMETER DRIVE	33-01128
Approved	DLR		
Issued	4-4-80		
Revised	6-16-83	Chg Ltr B **FREIGHTLINER CORPORATION** PORTLAND, OREGON	PAGE 1

E

1. ELECTRONIC TACHOMETER DRIVE LOCATION

ENGINE	MODEL	LOC. ON FLYWHL HSG.	LOC. #
(CAT)	3406 3408	UPPER RH SIDE @ 140° LWR RH SIDE @ 140°	1 1
(CUM)	NTC, L-10 SERIES KT450 VT SERIES	LWR RD SIDE @ 159° LWR RH SIDE @ 128° LWR RH SIDE @ 125°	1 1 1
(DDE)	6171 8V SERIES 6V SERIES	UPPER LH SIDE @ 55° LWR RH SIDE @ 118°	3 1



REAR VIEW OF FLYWHL HOUSING

2. MECHANICAL TACHOMETER DRIVE FITTING LOCATIONS

ENGINE	MODEL	FITTING POINTS	STD LOCATION
CUM	VT Series	up	Top of fuel pump
	Inline	up	LH - top of fuel pump
DDE*	V-8	forward	Forward end RH camshaft
	Inline	rear	LH rear camshaft (can be moved to RH; check if rotation direction OK).
CAT	3406 3408	up up	LH side FWD of fuel pump Top of fuel pump

*NOTE: On Detroit Diesel 8V-92T and 8V-71T rear mounted turbo series, with power steering, mechanical tachmoeter is to be connected by authorized Detroit Diesel Allison distributor or dealer only.

3. ELECTRIC TACHOMETER DRIVE CONNECTIONS

ALTERNATOR	CONNECTIONS	REMARKS
Delco 62A	-	Use only mechanical drive tachometer (see above).
Delco (all except Model 62A)	Across any two phase taps	Circuits No. 111 and No. 112
Motorola models & Leece-Neville	One wire to phase tap other to ground	Circuits No. 111 and No. 112

Compiled	F. FREER	SHOP PRACTICE FULL FLOW OIL FILTER	33-01129
Approved	L M		
Issued	4-4-80		
Revised	6-23-80	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	

Remote Mounted Full Flow Filters

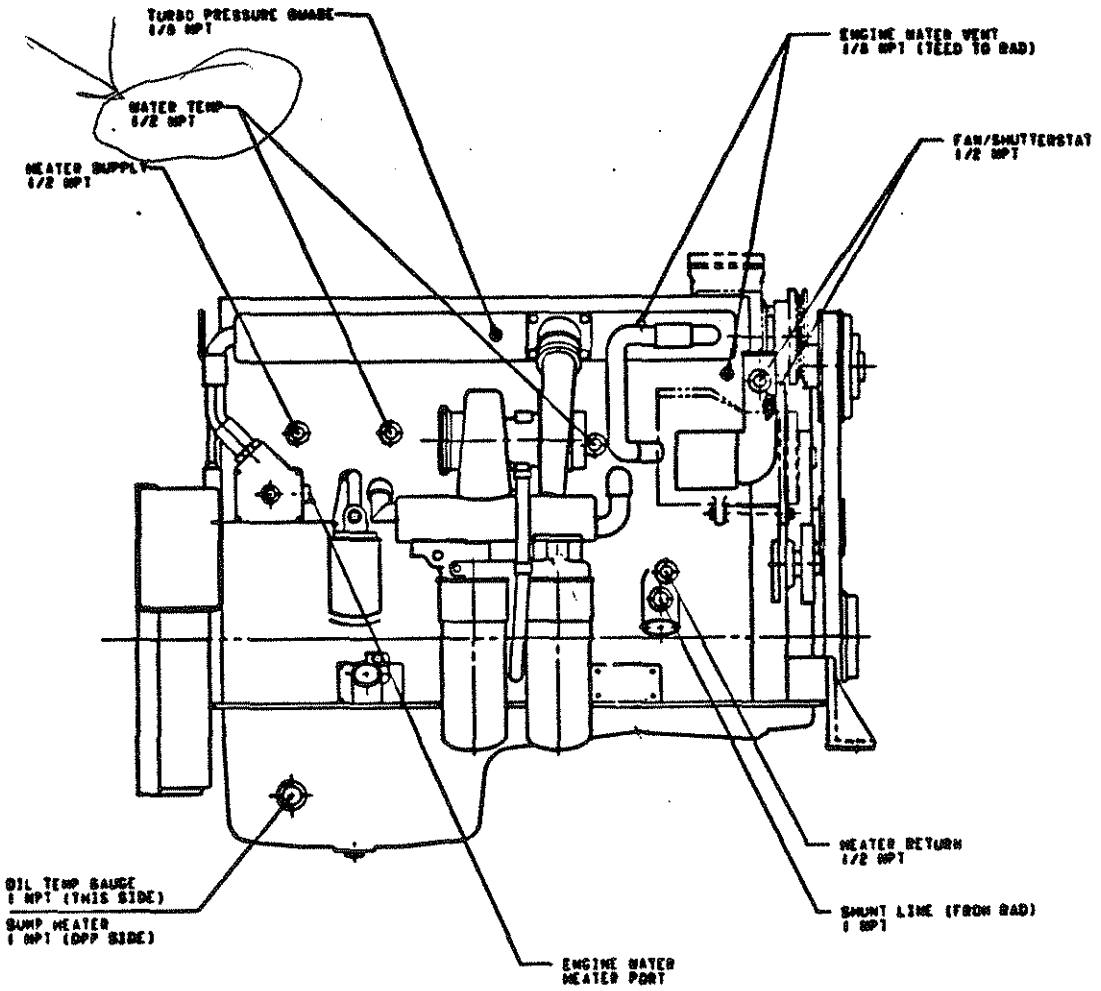
These filters must be connected to the engine by hoses of proper construction and size as listed below:

A

ENGINE		HOSE SIZE	CONSTRUCTION	HOSE
CAT	3408	#20	PER SAE# 100R5	48-2004 or Equiv.
DDE	INLINE 6V92 Series 8V71 Series	#16		
	12V71 Series 8V92 Series	#20		

Compiled	HEILESON	SHOP PRACTICE THERMAL SWITCH/PLUMBING LOCATIONS CUMMINS L-10 SERIES	33-01130
Approved	[signature]		
Issued	6-16-83		
Revised	2-6-85	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	

CUMMINS L-10 SERIES



A

Radiator Piping

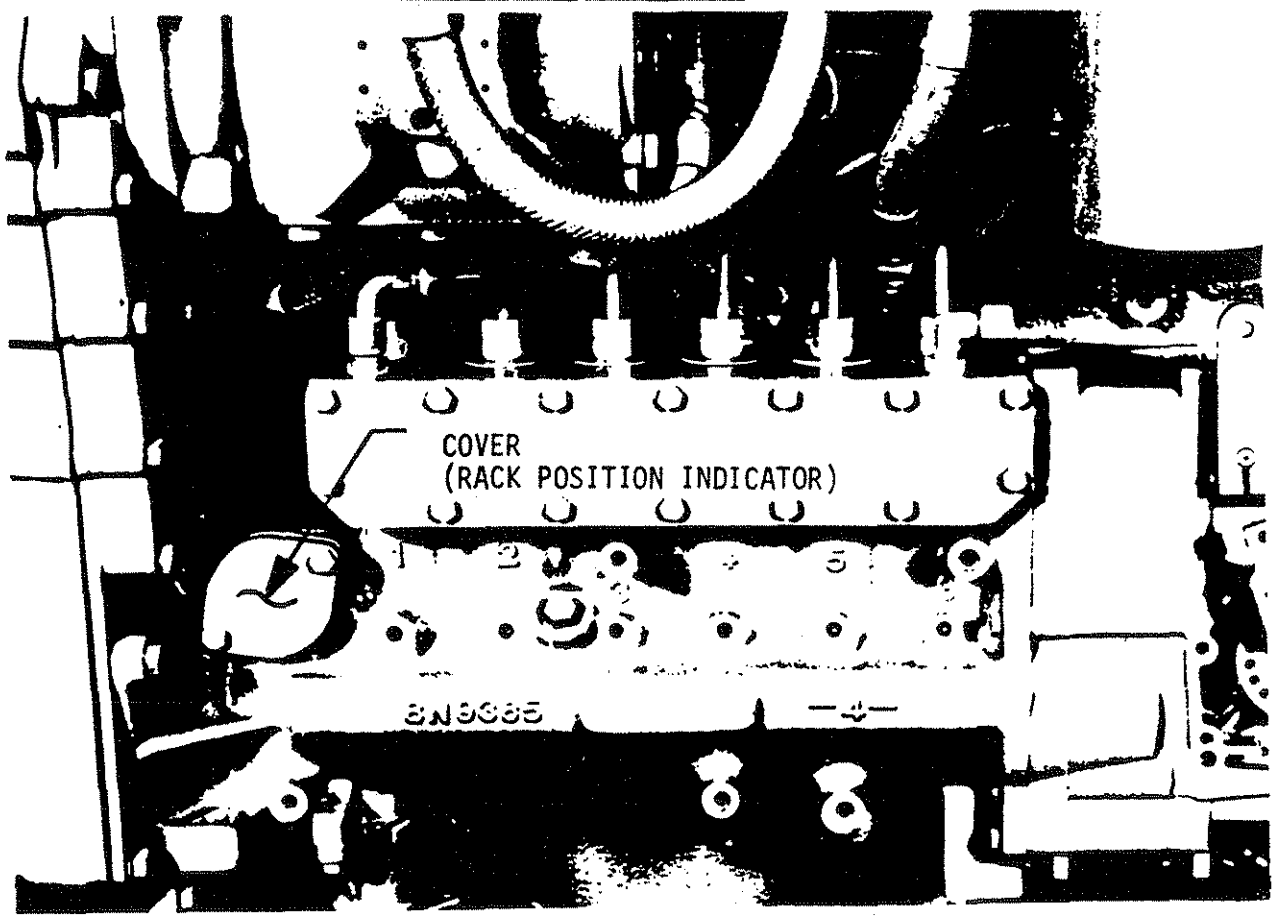
- L-10 Standard See D05-12464
- L-10 OA Series See D05-12635

Compiled	McIntosh	SHOP PRACTICE CAT 3406B SERVICE ACCESSIBILITY	33-01131
Approved			
Issued	6-9-84		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

CAT 3406B ENGINES

DO NOT route wiring/plumbing, etc., in area of rack position indicator cover. The cover is removed by service personnel who must have hand and tool clearance for making fuel settings and checks.

L. H. FWD VIEW OF 3406

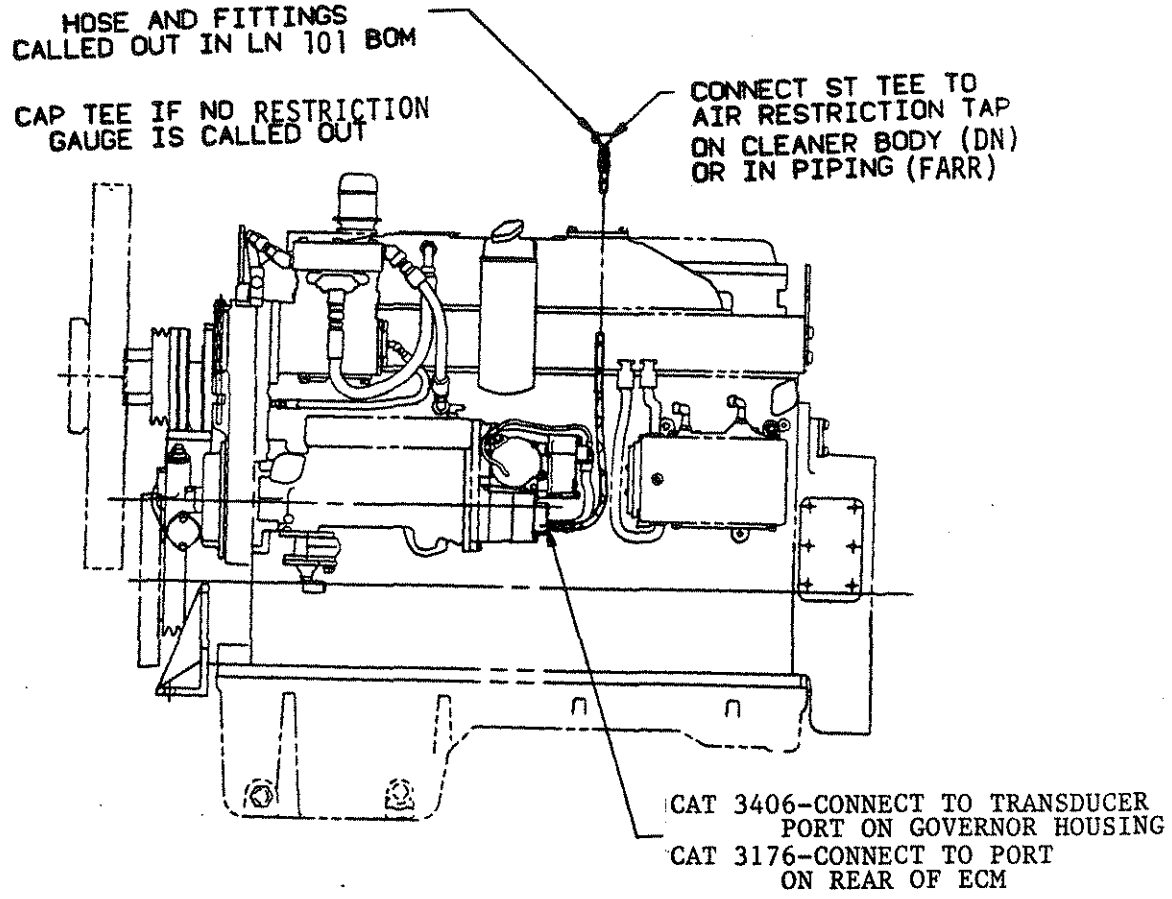


Compiled	RINARD	SHOP PRACTICE CATERPILLAR PEEC ENGINES AIR CONNECTION	33-01132 PG 1 OF 1
Approved			
Issued	09/04/87		
Revised	02/13/89	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2006-13

INLET AIR PRESSURE CONNECTION

The electronic control systems for these engines require an air pressure transducer line from the clean side of the air intake system (between the air cleaner and turbocharger) to the electronic module. This connection on a 3406 PEEC is at the rear of the governor housing and is a 7/16-20 37 degree flare port. The 3176 connection is at the rear of the ECM control module and is a 1/4 nptf.

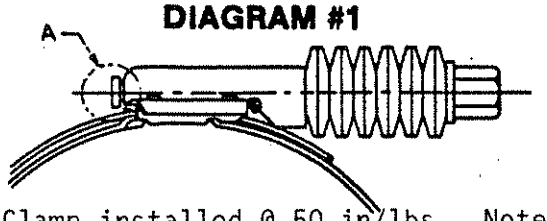
To prevent dirt from entering the engine if the transducer line fails, a filter must be provided in the transducer line where it connects to the air inlet system. This filter is provided with the Donaldson units and is called out on spec line 192 for Farr units.



Compiled	S.Heileson	SHOP PRACTICE CHARGE AIR COOLER HOSE CONSTANT TORQUE CLAMPS	33-01133
Approved	SJH		
Issued	5-4-87		
Revised		Chg Ltr **FREIGHTLINER CORPORATION** PORTLAND, OREGON	

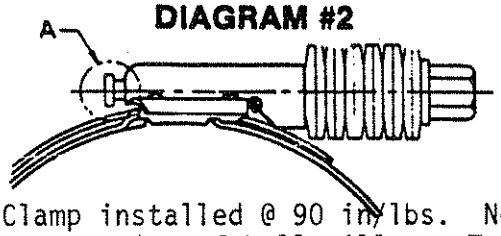
Charge air cooler hose clamps to be installed as per Diagram #2 (90± 5 in/lbs.).

DIAGRAM #1



Clamp installed @ 50 in/lbs. Note: Screw tip 'A' protruding slightly from housing.

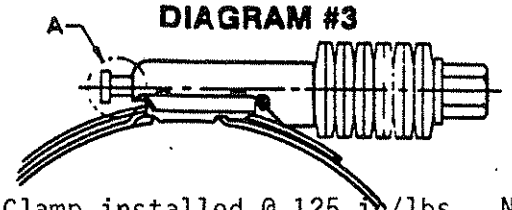
DIAGRAM #2



23-11680-004

Clamp installed @ 90 in/lbs. Note: Screw tip 'A' protruding and compression of bellevilles. Torque loss from rubber hose compression ("cold flow") after initial installation will leave clamp torque @ 70 - 80 in/lbs.

DIAGRAM #3



Clamp installed @ 125 in/lbs. Note: Screw tip 'A' extended well beyond the housing. Bellevilles are compressed to about 90% of flat.

COMPILED	R D W
APPRV	D FEHER
ISSUE DATE	07/01/88
REV DATE	07/29/96
CHG LTR	A

SHOP PRACTICE

CAT PEEC ACCELERATOR INSTALLATION AND ADJUSTMENT

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-01134

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-011 FOR CAT PEEC ACCELERATOR INSTALLATION AND ADJUSTMENT.

COMPILED	ERK	SHOP PRACTICE REMOVAL ENGINE REAR LIFTING EYE	SECTION NUMBER 33-01135
APPRV	DCR		
ISSUE DATE	07/11/91		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0001-012 FOR REMOVAL, REAR ENGINE LIFTING EYE.

COMPILED	F.FREER
APPRV	DCR
ISSUE DATE	04/07/65
REV DATE	06/15/94
CHG LTR	M

SHOP PRACTICE

CLUTCH
CONTENTS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-02100

PAGE
1 OF 1

PA2101-05

33-02101 CLUTCH PEDAL AND LINKAGE ADJUSTMENT
33-02102 CLUTCH INSTALLATION, MANUAL TRANSMISSION
33-02108 LUBE EXTENSION TUBE, RELEASE BEARING
33-02109 MECHANICAL CLUTCH PEDAL AND LINKAGE ADJUSTMENT

COMPILED	HJR
APPRV	VWS
ISSUE DATE	04/07/65
REV DATE	07/29/96
CHG LTR	D

SHOP PRACTICE

CLUTCH PEDAL AND LINKAGE ADJUSTMENT-COE/IE

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-02101

PA2042-72

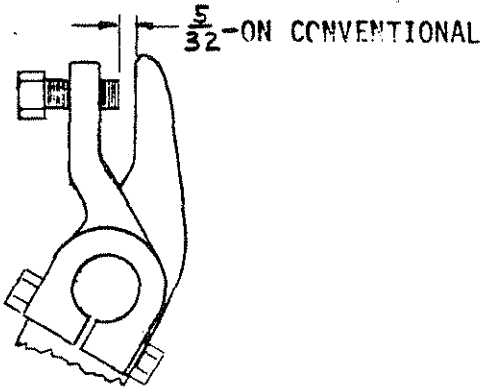
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0002-001/002 FOR CLUTCH PEDAL AND LINKAGE ADJUSTMENT-COE/IE.

Compiled	HJR	SHOP PRACTICE CLUTCH PEDAL AND LINKAGE ADJUSTMENT	33-02101
Approved	VWS		
Issued	4/7/65		
Revised	1-30-84	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

The internal clutch adjustment must be correct before the linkage or controls can be adjusted. If you know this has not been done or if the adjustments to the linkage do not produce the desired results, check the internal adjustment according to Section 02103.

A

1. Free Pedal*
   -Conventional
   With the rod adjusted for length, the free pedal is adjusted to 1 1/4" by means of the adjusting screw on the release shaft adjuster. About 5/32" free travel at this point will give approximately this free pedal travel.



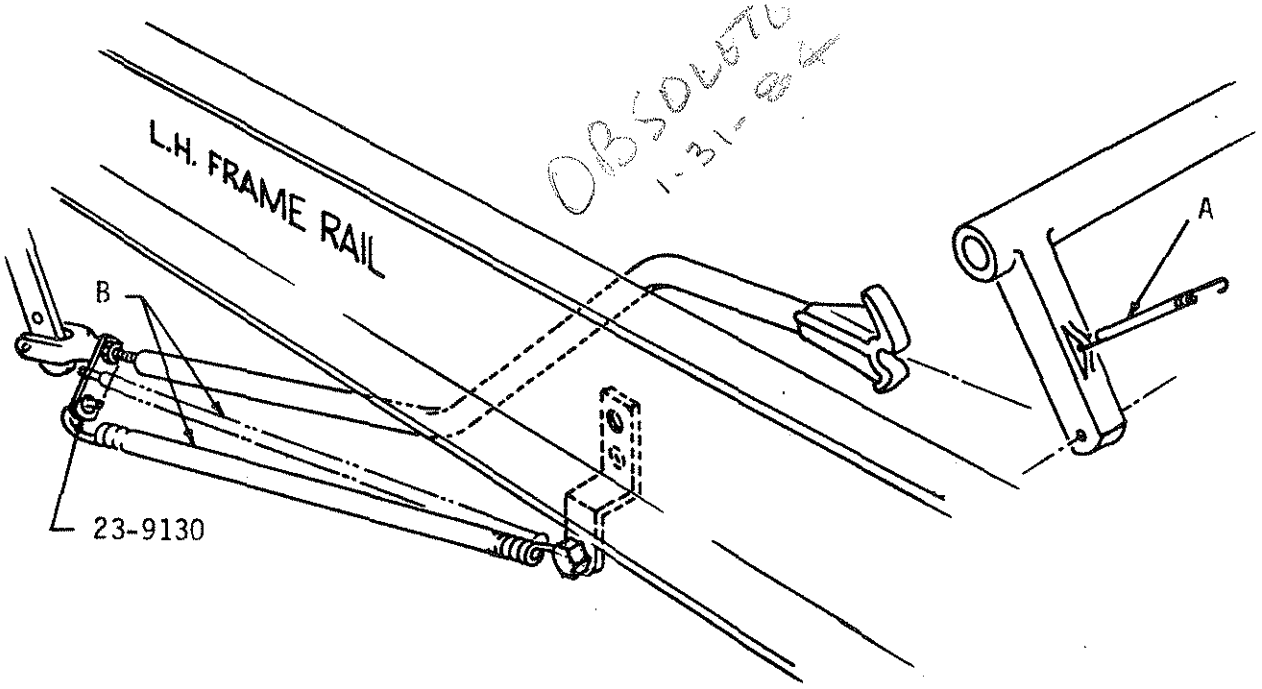
* Compare 33-02103 p.1., A.9.

G

D. CLUTCH RETURN SPRINGS, COE

There are two externally mounted clutch return springs:

1. Clutch Pedal Return Spring ("A" in Figure)
Attach spring to lightening hole in cab support gusset and clutch pedal cross shaft arm notch. Insure proper tension by extending spring from one to two inches, in pedal up position. CAUTION: Do not nick or otherwise damage anchor loops at installation and avoid cocking or binding at the ends.



OBSOLETE 1-31-84

2. Clutch Rod or Lever Return Spring ("B" in figure)
This spring is to be fastened by passing a 1/4-28 x 1-1/2" cap screw through the spring eye and running a plain hexagon nut hand tight up to the end of the threads. The tip of the cap screw is then passed through a 9/32" hole in a bracket attached to the webb of the frame, and then another nut tightened firmly in place. The hard wire hook provided at the other end of the spring is then passed through eigher (a) the fork of the clevis on the clutch rod, making sure it seats fully; or (b) the hole in 23-9130-003 which is called out in clutch inst for the following engines: 8V-71, 8V-71T, VT Series.

Locate 23-9130-003 between clevis and tightening nut and install in a downward direction to keep return spring from rubbing clutch rod. DDE 8V Series engines used with bumper A-frames require the 23-9130 be located on the rearmost, bottom flange, A-Frame bolt rather than as illustrated.

CAUTION: Avoid placing excessive side force against the eye of the spring and do not over-stretch.

RETYPED 8-26-77

COMPILED	HEILESON	SHOP PRACTICE CLUTCH INSTALLATION	SECTION NUMBER 33-02102
APPRV	D R		
ISSUE DATE	04/07/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	R		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0002-003 FOR CLUTCH INSTALLATION PROCEDURE.

COMPILED	HEILESON
APPRV	DR
ISSUE DATE	04/07/65
REV DATE	04/11/94
CHG LTR	P

SHOP PRACTICE
CLUTCH INSTALLATION
FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-02102
PAGE 1 OF 8
P2414J-01

1. CLEAN FLYWHEEL AND TRANSMISSION DRIVE SHAFT

M REMOVE WITH A GOOD SOLVENT ALL DIRT AND RUST PREVENTION MATERIAL FROM THE FLYWHEEL AND THEN DRY. BE SURE TO CLEAN THE MOUNTING SURFACES ON THE FLYWHEEL AND FLYWHEEL HOUSING.

2. INSTALL PILOT BEARING

M INSTALL THE PILOT BEARING IN THE FLYWHEEL BORE BY DRIVING THE OUTER RING ONLY UNTIL IT IS FIRMLY SEATED.

3. FLYWHEEL MOUNT

3.1 FLAT FLYWHEEL MOUNT

NO PRIOR PREPARATION OTHER THAN AS SPECIFIED IN PARAGRAPH 1.

3.2 POT TYPE FLYWHEEL MOUNT

3.2.1 INSTALL DRIVE PINS (14 INCH - 2 PLATE CLUTCH)

3.2.1.1 THESE SHOULD BE INSTALLED WITH AN ALIGNMENT TOOL TO ASSURE THAT THE SURFACES ARE PARALLEL WITH THE SHAFT CENTER LINE. THE SIX PINS ARE PLACED IN HOLES 60 DEGREES APART, OTHERWISE THE PLATE WILL NOT MOVE FREELY.

3.2.2 INSTALL DRIVE PIN SET SCREWS

3.2.2.1 USE SET SCREWS OF THE LOCKING TYPE, OR IF NOT AVAILABLE, USE TWELVE OF THE NON-LOCKING TYPE. TORQUE TO 25 FT.LBS. (REFER TO FIGURE 1)

L

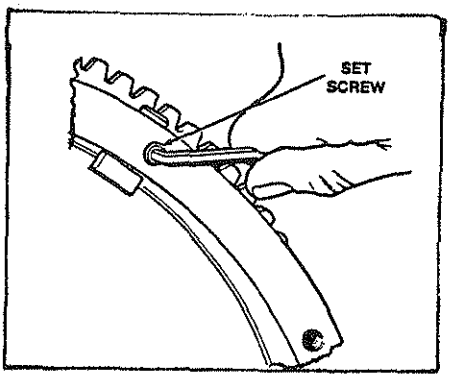


FIGURE 1

4. INSTALLATION AND ASSEMBLY OF CLUTCH PARTS *

*CAUTION: CLUTCH DISCS MAY BE MARKED "FLYWHEEL SIDE" AND REAR DISCS MARKED "PRESSURE PLATE SIDE". INSTALL AS NOTED.

4.1 SPICER 350MM ANGLE RING SINGLE PLATE PUSH TYPE CLUTCH.

4.1.1 INSERT CLUTCH DISC ALIGNMENT TOOL OR SPLINED MAIN DRIVEN GEAR THROUGH CLUTCH DISC HUB AND INTO FLYWHEEL PILOR BEARING TO POSITION DISC. (REFER TO FIGURE 2)

NOTE: WHEN INSTALLING THE DRIVEN DISC ASSEMBLY, BE SURE TO HAVE THE LONGER END OF HUB FACE TOWARD THE TRANSMISSION.

4.1.2 MOUNT CLUTCH TO THE FLYWHEEL WITH GRADE 8 CAPSCREWS AND LOCKWASHERS TIGHTENED IN ACCORDANCE WITH PARAGRAPH 5.1. REFER TO FIGURE #3 FOR TIGHTENING SEQUENCE.

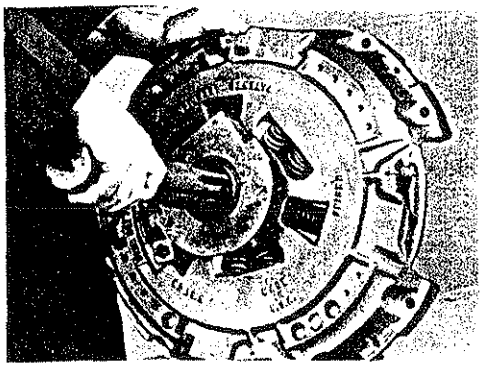
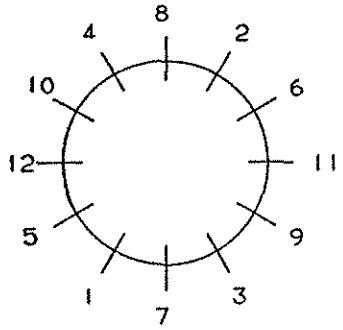
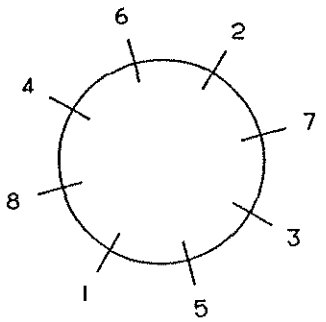


FIGURE 2

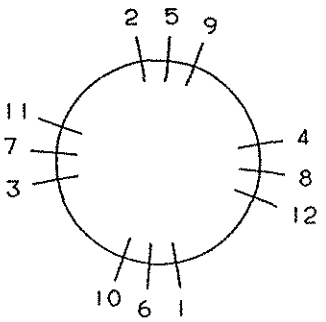
4. INSTALLATION AND ASSEMBLY OF CLUTCH PARTS (CONTINUED)



SPICER ANGLE RING



SPICER (EXCEPT ANGLE RING)
ROCKWELL
EATON VALEO

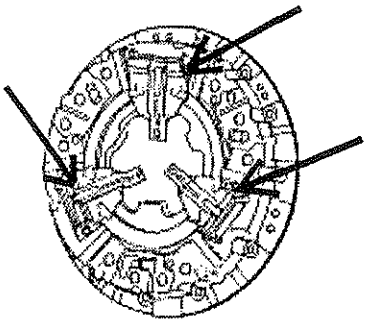


EATON VALEO

FIGURE 3
TIGHTENING SEQUENCES

4.1.3 **REMOVE SHIPPING BLOCKS.** BLOCKS ARE LOCATED BETWEEN TAIL OF LEVER AND FLYWHEEL RING OF CLUTCH ASSEMBLY. (REFER TO FIGURE 4)

NOTE: CLUTCH WILL NOT FUNCTION UNLESS BLOCKS ARE REMOVED.



Shipping Blocks
350mm (14 inch) Clutch

FIGURE 4

4.1.4 REMOVE ALIGNMENT TOOL.

4.2 SPICER 14 INCH STAMPED COVER SINGLE PLATE AND 17 INCH EATON VALEO CLUTCHES.

M 4.2.1 INSTALL TWO GUIDE STUDS 3/8-16 X 2 INCHES LONG IN THE FLYWHEEL AT THE 9 O'CLOCK AND 2 O'CLOCK POSITIONS.

4.2.2 INSTALL THE DISC BY INSERTING THE ALIGNING TOOL THROUGH THE SPLINE AND INTO THE PILOT BEARING. MAKE SURE THE SIDE MARKED "PRESSURE PLATE SIDE" FACES THE PRESSURE PLATE.

4.2.3 WITH THE ALIGNING TOOL STILL IN PLACE, CAREFULLY SLIDE THE CLUTCH ASSEMBLY OVER THE ALIGNING TOOL.

M 4.2.4 MOUNT CLUTCH TO THE FLYWHEEL WITH GRADE 8 CAPSCREWS AND LOCKWASHERS. REPLACE THE TWO GUIDE STUDS WITH CAP SCREWS, TIGHTEN IN ACCORDANCE WITH PARAGRAPH 5.1.

4. INSTALLATION AND ASSEMBLY OF CLUTCH PARTS (CONTINUED)

4.3 SPICER 14 INCH STAMPED COVER TWO PLATE CLUTCH

4.3.1 PLACE THE FRONT DISC AGAINST THE FLYWHEEL WITH THE SIDE MARKED "FLYWHEEL" FACING THE ENGINE.

4.3.2 INSTALL TWO GUIDE STUDS, 3/8-16 X 3 INCHES LONG IN THE FLYWHEEL AT THE 11 O'CLOCK AND 1 O'CLOCK POSITIONS.

4.3.3 INSTALL THE STRAP DRIVE INTERMEDIATE PLATE OVER THE GUIDE STUDS. THE FOUR THROUGH HOLES AT THE DRIVE STRAPS ARE THE PILOT HOLES FOR THE ADAPTER RING. MAKE SURE THE SIDE MARKED "FLYWHEEL SIDE" FACES THE FLYWHEEL. (DRIVE STRAPS MUST FACE PRESSURE PLATE) RAISE THE FRONT DISC TO FIT INTO THE INTERMEDIATE PLATE OPENING.

4.3.4 INSTALL THE REAR DISC BY INSERTING THE ALIGNING TOOL THROUGH BOTH SPLINES AND INTO THE PILOT BEARING. MAKE SURE THE REAR DISC SIDE MARKED "PRESSURE PLATE SIDE" FACES THE PRESSURE PLATE.

4.3.5 SLIDE THE CLUTCH ASSEMBLY OVER THE GUIDE STUDS AND AGAINST THE SPACER RING. MOUNT THE CLUTCH TO THE FLYWHEEL WITH GRADE 8 CAPSCREWS AND LOCKWASHERS TIGHTENED IN ACCORDANCE WITH PARAGRAPH 5.1. REFER TO FIGURE #3 FOR TIGHTENING SEQUENCE.

4.3.6 REPLACE THE TWO GUIDE STUDS WITH CAP SCREWS. TIGHTEN IN ACCORDANCE WITH PARAGRAPH 5.1.

4.3.7 REMOVE THE TWO WOODEN BLOCKS FROM BETWEEN THE RELEASE BEARING HOUSING AND FLYWHEEL RING. REMOVE ALIGNING TOOL.

4.4 14 INCH-2 PLATE ANGLE SPRING CLUTCH (CAST COVER)

4.4.1 PLACE FRONT DRIVEN DISC ON FLYWHEEL WITH HUB FLANGE OF DISC AWAY FROM THE ENGINE AND TOWARD THE TRANSMISSION.

4.4.2 INSTALL INTERMEDIATE PLATE IN FLYWHEEL, LOCATING THE DRIVE SLOTS ON THE SIX DRIVE PINS. CHECK TO SEE THAT PLATE FLOATS FREELY ON THE PINS.

4.4.3 INSTALL THE REAR DRIVEN DISC WITH THE LONG HUB OF DISC AWAY FROM THE ENGINE.

4.4.4 INSTALL THE REAR DISC BY INSERTING THE ALIGNING TOOL THROUGH BOTH SPLINES AND INTO THE PILOT BEARING. MAKE SURE THE REAR DISC SIDE MARKED "PRESSURE PLATE SIDE" FACES THE PRESSURE PLATE.

4.5 14 INCH "SUPER DUTY" INSTALLATIONS

4.5.1 ON 14 INCH "SUPER DUTY" INSTALLATIONS BE SURE TO USE THREE ANTI-RATTLE SPRINGS EQUALLY SPACED BETWEEN THE DRIVE PINS. INSTALL WITH ROUNDED SECTIONS TOWARDS THE FLYWHEEL FACE (AS INDICATED BY ARROW ON ANTI-RATTLE SPRING). 14 INCH "SUPER DUTY" CLUTCHES HAVE THICKER INTERMEDIATE PLATES AND FOUR CERAMIC BUTTONS. DO NOT MIX STANDARD AND "SUPER DUTY " DISCS. **CAUTION:** WEAR HEAVY GLOVES WHEN INSTALLING ANTI RATTLE SPRINGS FOR SAFETY REASONS.

4. INSTALLATION AND ASSEMBLY OF CLUTCH PARTS (CONTINUED)

4.6 15 1/2 INCH 2 PLATE CLUTCH WITH POSITIVE SEPARATOR

4.6.1 AFTER INSTALLING REAR DISC, POSITION THE INTERMEDIATE PLATE SO THAT THE PINS SET TOWARD THE FLYWHEEL SIDE. THE PINS SHOULD BE FLUSH ON THE PRESSURE PLATE SIDE.

4.6.2 USING A 1/4 INCH DIAMETER TOOL, LIGHTLY TAP EACH PIN TOWARD THE FLYWHEEL, THROUGH THE 5/16 INCH DIAMETER HOLE. THE PINS SHOULD NOW BE FLUSH AGAINST THE FLYWHEEL.

4.6.3 THE SEPARATOR PIN WILL ALLOW THE INTERMEDIATE PLATE TO MOVE BACK .025-.035 INCH WHEN THE CLUTCH IS RELEASED GIVING CONSTANT GAP ON BOTH SIDES OF THE INTERMEDIATE PLATE.

5. ASSEMBLE PRESSURE PLATE ASSEMBLY TO FLYWHEEL

5.1 POSITION PRESSURE PLATE ASSEMBLY ON FLYWHEEL. TIGHTEN THE GRADE 8 CAPSCREWS EVENLY, PROGRESSING AROUND THE FLYWHEEL TO AVOID COCKING AND BINDING OF FLYWHEEL RING PILOT. TIGHTEN THE GRADE 8 CAP SCREWS IN ACCORDANCE WITH THE FOLLOWING: P

CLUTCH SIZE		TORQUE
SINGLE PLATE		
350MM SPICER	-	25-35 FT/LBS.
14 INCH SPICER	-	25-35 FT/LBS.
14 INCH EATON	-	25-35 FT/LBS.
16 INCH EATON	-	40-50 FT/LBS.
17 INCH EATON	-	40-50 FT/LBS.
TWO PLATE		
14 INCH STAMPED	-	25-35 FT/LBS.
14 INCH CAST	-	25-35 FT/LBS.
15 1/2 INCH CAST	-	40-50 FT/LBS.

5.2 HOLDING DEVICES.

5.2.1 AS THEY COME FROM THE MANUFACTURER, MANY CLUTCHES HAVE WOOD BLOCKS BETWEEN THE RELEASE BEARING AND THE CLUTCH COVER FOR SHIPPING PURPOSES. EATON VALEO CLUTCHES HAVE "U" CLIPS FOR THIS SAME PURPOSE. FOR PROPER OPERATION OF THE CLUTCH, THESE BLOCKS AND "U" CLIPS MUST BE REMOVED AFTER INSTALLATION IS COMPLETED.

5.2.2 THE FOLLOWING IS A TABLE OF CLUTCHES AND THE MEANS USED TO HOLD THE ASSEMBLY FOR MOUNTING. THE DEVICES ARE TO BE REMOVED AND DISCARDED AFTER INSTALLATION OF THE CLUTCH.

MANUFACTURER	CLUTCH TYPES	HOLDING DEVICES
ROCKWELL	14" -TWO PLATE	WOOD BLOCKS
ROCKWELL	15 1/2"-TWO PLATE	WOOD BLOCKS
SPICER	13" -ONE PLATE	WOOD BLOCKS
SPICER	14" -ONE PLATE	WOOD BLOCKS
SPICER	14" -TWO PLATE	WOOD BLOCKS
SPICER	15 1/2"-TWO PLATE	WOOD BLOCKS
EATON VALEO	14", 16", 17"	4 "U" CLIPS

6. CLUTCH ADJUSTMENT

6.1 PULL TYPE CLUTCH ADJUSTMENT:

K 6.1.1 ALL PULL TYPE CLUTCHES WITH CLUTCH BRAKES HAVE 1/2 INCH TO 9/16 INCH CLEARANCE BETWEEN THE CLUTCH BRAKE AND THE RELEASE BEARING REAR FACE. REFER TO FIGURE #4.

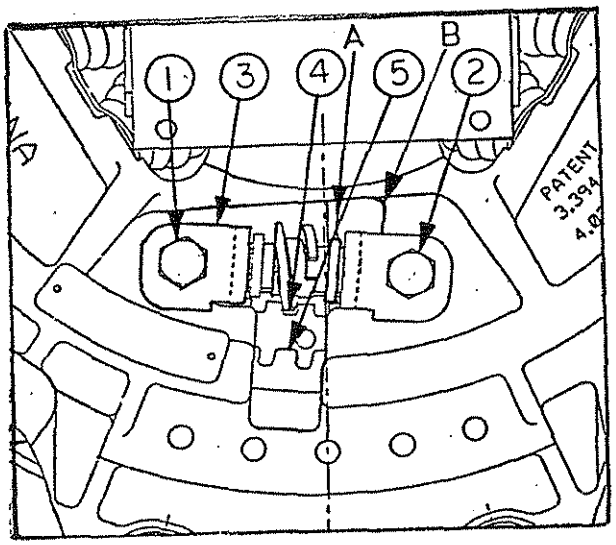


FIGURE 5

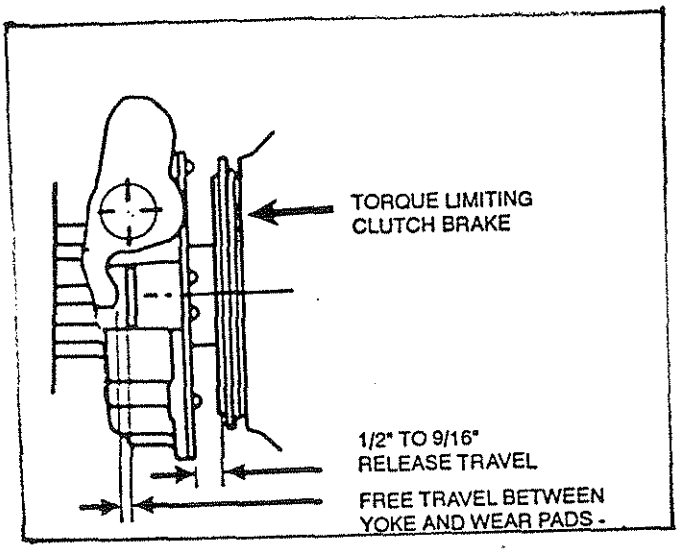


FIGURE 6

N

NOTE: ORIENTATION OF CLUTCH BRAKE NOT RELEVANT.

6.2 SPICER SELF ADJUSTING CLUTCH (REFER TO FIGURE 5)

6.2.1 LOOSEN SCREW NO. 1 ONE FULL TURN.

6.2.2 REMOVE SCREW NO. 2.

6.2.3 PIVOT ASSEMBLY NO. 3 TOWARDS DRIVE SHAFT TO DISENGAGE WORM AT LOCATION NO. 4.

6.2.4 WRENCH TIGHTEN SCREW NO. 1 TO HOLD ASSEMBLY IN THIS POSITION.

M 6.2.5 USE SCREWDRIVER OR ADJUSTING TOOL AT LOCATION NO. 5 TO ADJUST FOR 1/2 INCH TO 9/16 INCH GAP AS SHOWN IN FIGURE #6.

6.2.6 LOOSEN SCREW NO. 1 ONE FULL TURN.

6.2.7 MOVE ADJUSTING RING SLIGHTLY AT LOCATION NO. 5 UNTIL WORM TEETH ENGAGE AND ASSEMBLY IS BACK IN POSITION (CAUTION: DO NOT USE FORCE).

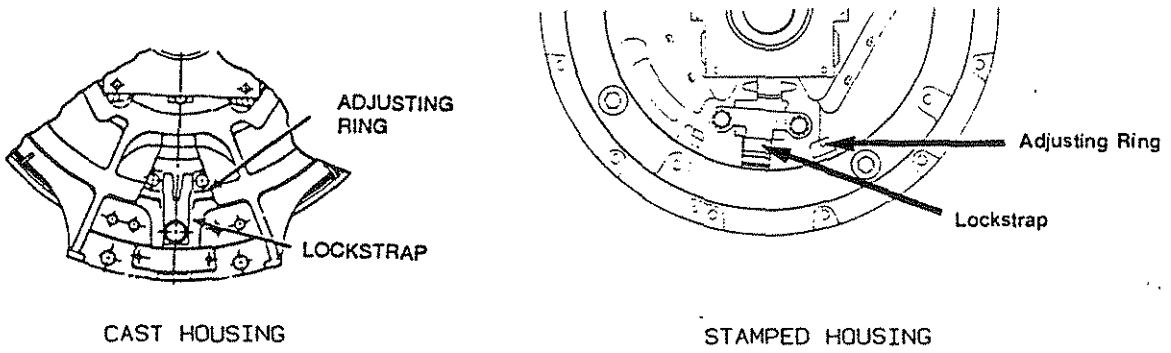
6.2.8 REPLACE SCREW NO. 2 AND TIGHTEN BOTH NO. 1 AND NO. 2 SCREWS. TIGHTEN TO 30-35 FT/LBS.

6. CLUTCH ADJUSTMENT (CONTINUED)

6.2.9 VISUALLY CHECK TO SEE IF ACTUATOR ARM BALL (A) IS INSERTED INTO RELEASE SLEEVE RETAINER (B). IF ADJUSTING ASSEMBLY IS INSTALLED PROPERLY, THE ADJUSTER ASSEMBLY SPRING WILL MOVE BACK AND FORTH AS PEDAL IS STROKED. (RECOMMEND USING A MIRROR FOR THIS CHECK).

NOTE: THE CLUTCH WILL NOT SELF-ADJUST IF THE ACTUATOR ARM BALL IS NOT INSERTED INTO THE RELEASE SLEEVE RETAINER OR IF THE RELEASE BEARING TRAVEL IS LESS THAN 1/2 INCH.

6.3 MANUAL ADJUSTING CLUTCH



CAST HOUSING

STAMPED HOUSING

FIGURE 7

6.3.1 THE ADJUSTMENT IS MADE BY ROTATING THE ADJUSTING RING AFTER MEASURING THE CLEARANCE BETWEEN THE REAR FACE OF THE RELEASE BEARING AND THE CLUTCH BRAKE.

6.3.1.1 FIRST, REMOVE THE LOCK CAP SCREW AND AND THE LOCK STRAP. NEXT, RELEASE THE CLUTCH AND HOLD IT IN THIS POSITION. TURNING THE ADJUSTING RING CLOCKWISE MOVES THE RELEASE BEARING TOWARDS THE TRANSMISSION DECREASING M THE CLEARANCE. TURNING THE ADJUSTING RING COUNTER CLOCKWISE MOVES THE RELEASE BEARING TOWARDS THE ENGINE INCREASING THE CLEARANCE. ONE FULL LUG ROTATION OF THE RING WILL MOVE THE RELEASE BEARING APPROXIMATELY .020 TO .030 INCH.

6.3.2 RE-ENGAGE THE CLUTCH AND REPLACE THE LOCK STRAP AND ITS CAP SCREW.

6. CLUTCH ADJUSTMENT (CONTINUED)

P **6.4 SPICER ADJUSTMENT FOR "EASY PEDAL" CLUTCH WITH "KWIK-ADJUST" COMPONENT**

6.4.1 INSERT A 5/8 INCH SOCKET OR BOXED END WRENCH THROUGH THE INSPECTION HOLE AND DEPRESS THE HEX HEADED BOLT, KEEPING THE WRENCH ON THE BOLT. (REFER TO FIGURE 8)

6.4.2 ROTATE THE BOLT CLOCKWISE TO DECREASE THE CLEARANCE BETWEEN THE RELEASE BEARING AND THE CLUTCH AND COUNTER CLOCKWISE TO INCREASE THE CLEARANCE.

6.4.3 THE "KWIK-ADJUST" WILL RE-ENGAGE AT A THIRD OF A TURN.

NOTE: ONE THIRD TURN OF HEX HEAD BOLT WILL RESULT IN .019 INCH OF RELEASE BEARING TRAVEL.

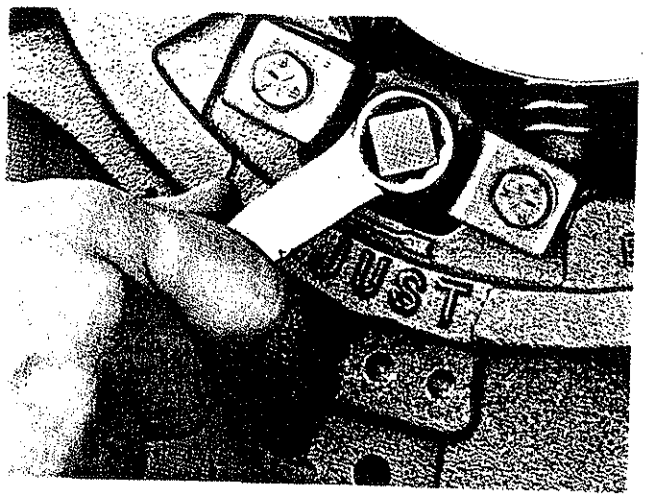


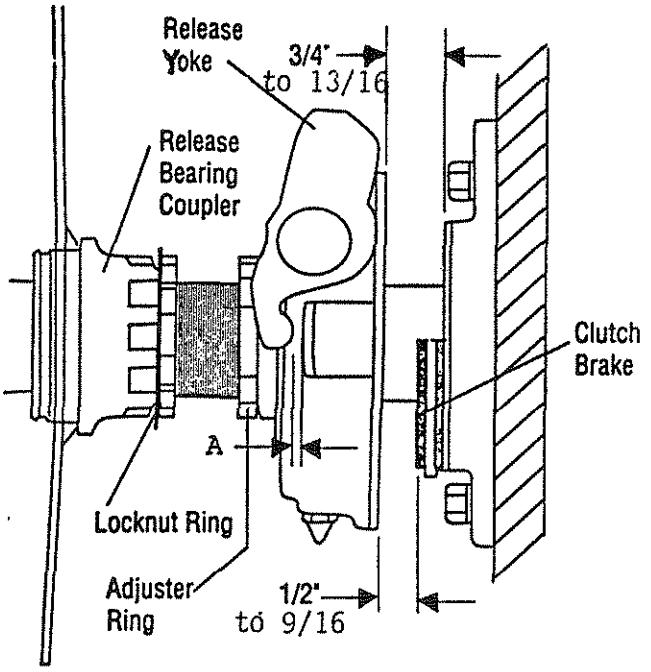
FIGURE 8

6. CLUTCH ADJUSTMENT (CONTINUED)

6.5 EATON VALEO CLUTCH ADJUSTMENT

6.5.1 LOOSEN THE LOCKNUT RING AND ROTATE SLEEVE WITH ADJUSTER RING TO GAIN PROPER RELEASE TRAVEL CLEARANCE. ON UNITS EQUIPPED WITH A CLUTCH BRAKE, THIS DISTANCE IS THIS DISTANCE IS 1/2 TO 9/16 INCH. ON UNITS WITHOUT A CLUTCH BRAKE, THIS DISTANCE IS 3/4 TO 13/16 INCH. (REFER TO FIGURE 9)

6.5.2 TIGHTEN THE LOCKNUT RING AGAINST THE RELEASE BEARING COUPLER USING TWO (2) SPANNER WRENCHES.



N A DIMENSION: .125"±.020 FOR MECHANICAL LINKAGE
.000" FOR HYDRAULIC LINKAGE.

FIGURE 9

7. POSITION RELEASE BEARING

7.1 PULL TYPE CLUTCH

7.1.1 POSITION THE BEARINGS SO THAT THE FLAT SECTION IS ON TOP. REMOVE THE SPLINE ALIGNMENT TOOL.

7.2 PUSH TYPE CLUTCH

7.2.1 INSTALL RELEASE BEARING ASSEMBLY ON TRANSMISSION INPUT SHAFT. ENSURE THAT THE RELEASE BEARING IS POSITIONED WITH THE "ZERK" FITTING IN THE DOWNWARD POSITION AND THE BEARING FACING TOWARDS THE ENGINE.

8. RELEASE BEARING GREASING

8.1 NEW CLUTCH RELEASE BEARINGS ARE PRELUBED. INITIAL LUBRICATION IS NOT NEEDED.

Compiled	A.J.R.	SHOP PRACTICE	33-02103
Approved	V.H.S.	INTERNAL CLUTCH ADJUSTMENT (ASSEMBLED VEHICLE)	
Issued	4/7/65	Chng Ltr: D FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1
Revised	4-4-80		

A. SPICER CLUTCHES

1. Remove the inspection cover at bottom of clutch housing.

2. Measure clearance between release bearing housing and clutch brake o.e./or spring plate hub, dependent on installation. If clearance is more or less than specified in chart, readjust clutch as follows:

3. Rotate engine flywheel until adjusting ring lock is exposed. Remove lock cap-screw and lock.

4. Release the clutch by locking the clutch pedal down in the depressed position.

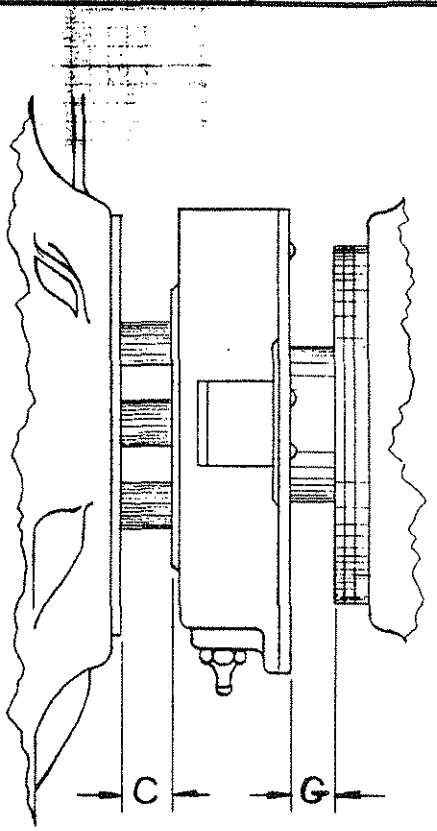
5. Use a pry bar to turn adjusting ring. Turn adjusting ring counterclockwise to move release bearing housing toward flywheel; clockwise to move bearing housing away from flywheel. Rotation or movement of one lug position will move the release bearing housing approximately 1/32 inch.

6. Remove the clutch pedal block to re-engage the clutch.

7. Recheck clearance as outlined in Step 2.

8. After clutch has been properly adjusted, install lock with lock screw and lock washer in notch provided in adjusting ring.

9. Check clearance between release yoke fingers and release bearing housing pads (see figure) or clearance between clutch release lever adjusting arm and linkage if the external adjusting arm is used. These clearances should be as indicated in "Clutch Pedal and Linkage Adjustment" 33-02101 page 1.



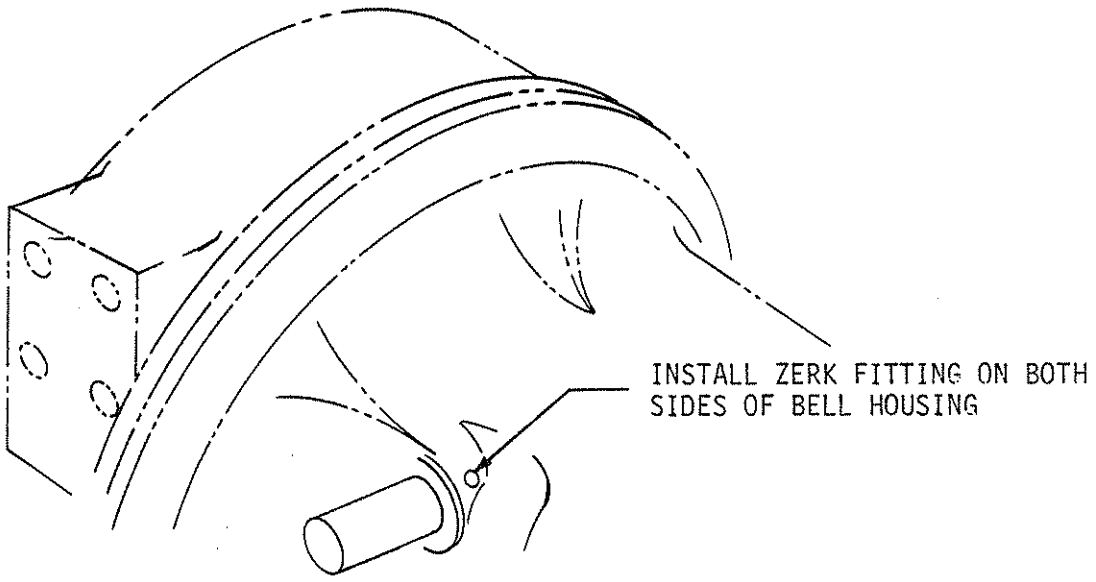
SERVICE	SPICER CLUTCH MODEL	C (Without Clutch Brake)	G (With Clutch Brake)
MANUAL ADJUSTING	14" 2-Plate	19/32 ± 1/32	1/2 ± 1/32
	15½" 2-Plate	19/32	
SELF ADJUSTING	14" 2-Plate		
	15-1/2" 2-plate		

D
A
B
C

Compiled	S. Helleson	SHOP PRACTICE CLUTCH CROSS SHAFT LUBRICATION	33-02107
Approved	DCK		
Issued	9-24-76	FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised	7-30-80	Chg Ltr A	

CLUTCH RELEASE CROSS SHAFT

The zerk fittings in the cross shaft bushings in the transmission bell housing must be installed during the transmission-engine assembly.



REVISED AND RETYPED " " CHANGE

COMPILED	E R K	SHOP PRACTICE LUBE EXTENSION TUBE RELEASE BEARING	SECTION NUMBER 33-02108
APPRV	H S B		
ISSUE DATE	12/07/93		PAGE 1 OF 1
REV DATE	07/29/96		
CHG LTR	A	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0002-004 FOR LUBE EXTENSION TUBE RELEASE BEARING PROCEDURE.

COMPILED	R P K	SHOP PRACTICE MECHANICAL CLUTCH PEDAL AND LINKAGE ADJUSTMENT	SECTION NUMBER 33-02109
APPRV	E R K		
ISSUE DATE	06/21/94		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0002-005 FOR MECHANICAL CLUTCH PEDAL AND LINKAGE ADJUSTMENT.

COMPILED	RPK
APPRV	ERK
ISSUE DATE	06/21/94
REV DATE	/ /
CHG LTR	-

SHOP PRACTICE

MECHANICAL CLUTCH PEDAL AND LINKAGE ADJUSTMENT

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-02109

PA2101-05

FL90/FL106 MECHANICAL CLUTCH LINKAGE INSTALLATION & ADJUSTMENT

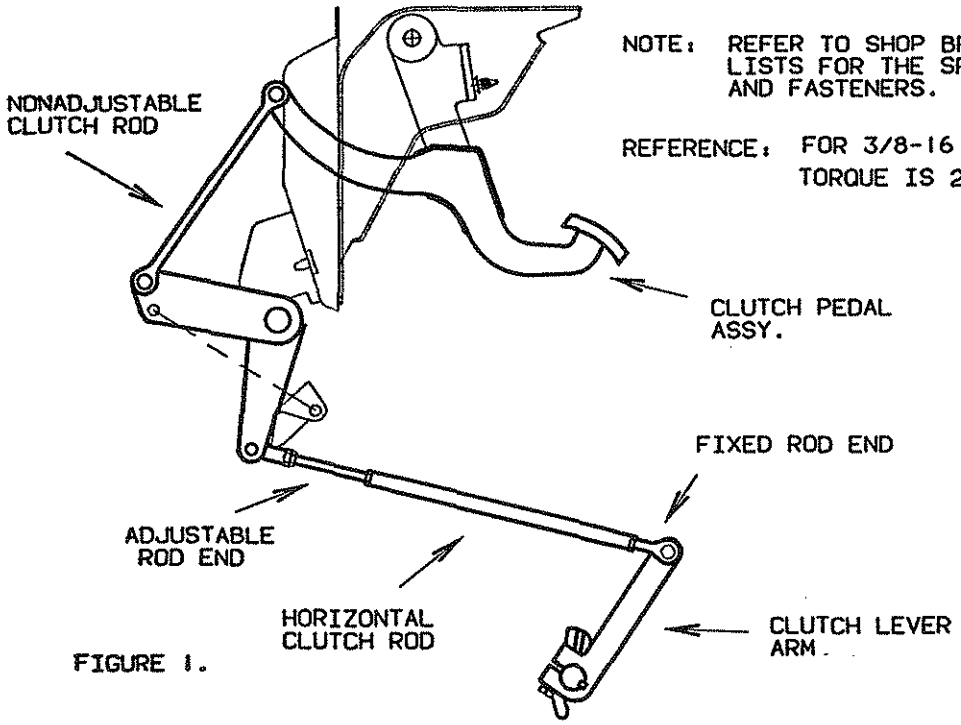


FIGURE 1.

NOTE: REFER TO SHOP BROADCAST OR ASSEMBLY LISTS FOR THE SPECIFIC SLUTCH LINKAGES AND FASTENERS.

REFERENCE: FOR 3/8-16 UNC FASTENERS, TORQUE IS 26±3 FT/LBS.

1 INSTALL HORIZONTAL CLUTCH ROD.

1.1 OBTAIN HORIZONTAL CLUTCH ROD AND ATTACH FIXED ROD END TO THE CLUTCH LEVER ARM.

1.2 SECURE THE OPPOSITE END OF THE CLUTCH ROD OUT OF THE WAY IN PREPARATION FOR INSTALLING THE CAB ON THE CHASSIS.

2. POSITION SPACER GAUGE (AFTER CAB HANG WITH NONADJUSTABLE CLUTCH ROD INSTALLED).

2.1 IF VEHICLE HAS AIR CAB SUSPENSION MAKE SURE CAB IS AT CORRECT HEIGHT.

2.2 FOR TRUCKS WITH ROCKWELL CLUTCHES ONLY--IN THE CAB POSITION SPACER (PART NO. BM851) BETWEEN THE CLUTCH PEDAL STOP AND THE CLUTCH PEDAL (SEE FIGURE 2).

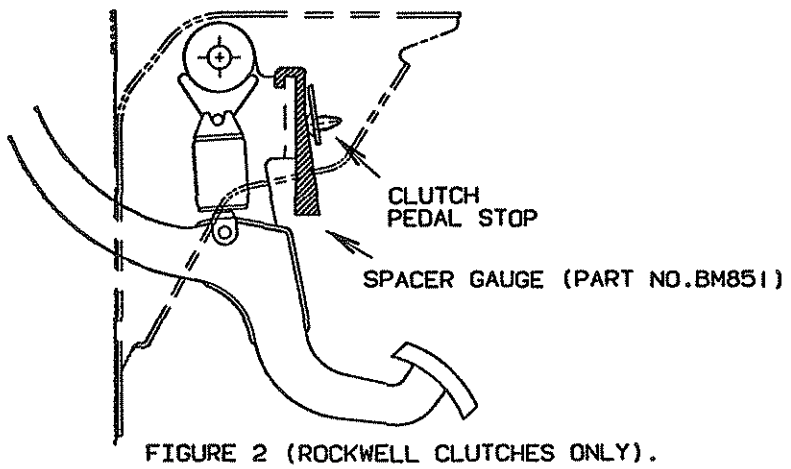


FIGURE 2 (ROCKWELL CLUTCHES ONLY).

2.3 FOR TRUCKS WITHOUT ROCKWELL CLUTCH--IN THE CAB POSITION SPACER (PART NO. BM855) BETWEEN THE CLUTCH PEDAL STOP AND THE CLUCH PEDAL (SEE FIGURE 3).

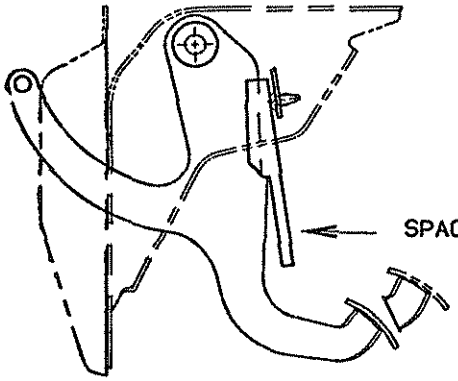


FIGURE 3 (NON ROCKWELL CLUTCHES ONLY).

3. CONNECT CLUTCH ROD TO CROSS SHAFT LEVER

3.1 PULL THE CLUTCH ROD FORWARD (ADJUSTABLE END) UNTIL IT STOPS WITHOUT APPLYING EXCESSIVE FORCE (FIGURE 4).

3.2 ADJUST LENGTH OF CLUTCH ROD BY ROTATING THE THREADED ROD IN OR OUT THE TUBE UNTIL THE ROD END LINES UP WITH THE HOLE IN THE CROSS SHAFT LEVER. SECURE CLUTCH ROD TO CROSS SHAFT LEVER. TIGHTEN JAM NUT ON THREADED ROD. REMOVE THE SPACER GAUGE (PART NO.BM851 OR BM855).

PRELIMINARY SETTING FOR RELEASE BEARING FREE TRAVEL IS NOW COMPLETE.

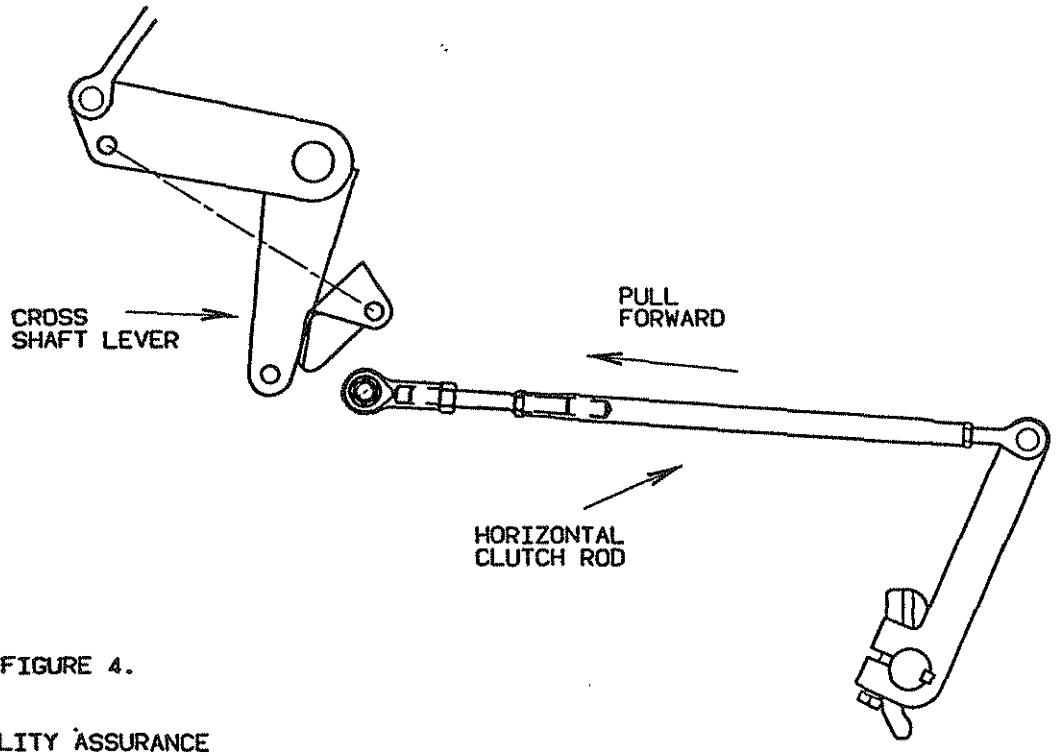


FIGURE 4.

QUALITY ASSURANCE

RELEASE BEARING FREE TRAVEL MUST BE VERIFIED INSIDE CLUTCH HOUSING. THIS IS MEASURED USING A FEELER GAUGE BETWEEN FORK AND RELEASE BEARING. SPECIFICATION IS .125" ±.020".

COMPILED	F.FREER
APPRV	DCR
ISSUE DATE	07/03/72
REV DATE	06/02/93
CHG LTR	AC

SHOP PRACTICE

CONTENTS
FUEL AND AIR INTAKE

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-03100

PA2101-02

	33-03101	FUEL SUCTION LINES
	33-03102	FUEL RETURN LINES
	33-03103	FUEL TANK MOUNTING
	33-03104	FUEL TANK, FILLER NECK LOCATION
	33-03105	FUEL TANK ASSEMBLY
AA	33-03107	FUEL TANK BAND STEP LOCATION
	33-03108	GLIDER PREPARATION
AA	33-03110	ASSEMBLY, CRIMP FITTING/FIBER HOSE
AC	33-03111	PROCESS CHART, FUEL TANK BUILDUP
AC	33-03112	INSTALLATION, SUCTION/RETURN TUBE, FUEL TANK BUILDUP
AC	33-03201	AIR INTAKE, GENERAL
	33-03202	BREAKING AIR INSTALLATION
	33-03203	AIR CLEANER INSTALLATION, FARR
	33-03204	INTAKE AIR RESTRICTION INDICATOR INSTALLATION
	33-03206	CONSTANT TORQUE CLAMPS
	33-03207	AIR CLEANER, REMOVABLE ELEMENT
	33-03208	STATIONARY AIR INSTALLATION
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AA	33-03211	AIR INTAKE DUCT INSTALLATION
	33-03212	AIR INTAKE PIPE INSTALLATION
	33-03213	AIR CLEANER, COWL MOUNTED
	33-03214	CHARGE AIR TURBO ADJUSTMENT, CUMMINS ENGINES

COMPILED	A Q	SHOP PRACTICE FUEL SYSTEM LINES	SECTION NUMBER 33-03101
APPRV	A Q		
ISSUE DATE	06/14/93		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	M		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-001 FOR FUEL SYSTEM LINES.

COMPILED	A.Q.	SHOP PRACTICE FUEL SYSTEM LINES	SECTION NUMBER 33-03101
APPRV	A.Q.		
ISSUE DATE	06/14/68		PAGE 1 OF 1
REV DATE	03/31/93	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	L		PH0488-83

GENERAL:

FUEL LINES:

K

LINES MUST BE LONG ENOUGH TO ACCOMODATE NORMAL MOVEMENTS OF PARTS TO WHICH THEY ARE ATTACHED WITHOUT INCURRING DAMAGE OR KINKS.

LINES MUST BE SECURED BY CLAMPING AND/OR ROUTING TO INSURE AGAINST CHAFING, KINKING OR OTHER CAUSES OF MECHANICAL DAMAGE.

LINES MUST BE ROUTED IN A CONTINUOUS UPWARD SLOPE FROM TANK TO AVOID HIGH AND LOW SPOTS IN THE HOSES.

LINES MUST BE ROUTED AT LEAST SIX(6) INCHES AWAY FROM EXHAUST PIPES. HEAT SHIELDS AND/OR HOSE INSULATION MUST BE USED IF HOSE IS LESS THAN SIX(6) INCHES FROM HEAT SOURCE.

LINES MUST BE ROUTED SO THAT ROUTINELY SERVICEABLE COMPONENTS (I.E. FUEL FILTERS, WATER SEPARATORS, AIR CLEANERS, DIPSTICKS, ETC.) CAN BE READILY ACCESSED FOR ADJUSTMENT OR ELEMENT REMOVAL WITHOUT THE NEED TO DISCONNECT LINES.

PIPE FITTINGS:

K

PIPE THREADS ARE TO BE COATED WITH 48-00094-108 OR WRAPPED WITH TEFLON TAPE.

FINGER TIGHTEN PIPE FITTINGS AND THEN WRENCH TIGHTEN ONE AND ONE HALF TURNS. TIGHTEN MORE IF NECESSARY TO SEAL.

JOGON ID=

COMPILED	A.Q	SHOP PRACTICE FUEL RETURN LINES	SECTION NUMBER 33-03102
APPRV	A.Q		
ISSUE DATE	03/11/87		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	J		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-002 FOR FUEL RETURN LINES PROCEDURE.

COMPILED	AQ	SHOP PRACTICE FUEL RETURN LINES	SECTION NUMBER 33-03102
APPRV	AQ		
ISSUE DATE	03/11/87		PAGE 1 OF 1
REV DATE	04/02/93	FREIGHTLINER CORPORATION PORTLAND, OREGON	PH0488-83
CHG LTR	H		

GENERAL:

REFER TO SPM 33-03101 FOR RULES APPLICABLE TO RETURN FUEL LINES.

E= 4/09/93 TIME=10.31 ACCESS=NONE
ON ID=

COMPILED	J L	SHOP PRACTICE FUEL TANK MOUNTING	SECTION NUMBER 33-03103
APPRV	A Q		
ISSUE DATE	11/11/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-003 FOR FUEL TANK MOUNTING.

COMPILED	J. LARSON	SHOP PRACTICE FUEL TANK MOUNTING	SECTION NUMBER 33-03103
APPRV	AQ		PAGE 1 OF 2
ISSUE DATE	11/11/85	FREIGHTLINER CORPORATION PORTLAND, OREGON	P1638J-01
REV DATE	08/09/94		
CHG LTR	D		

A. CLEANLINESS:

CLEANLINESS IS THE FIRST RULE FOR ALL FUEL SYSTEM INSTALLATIONS. FILTERS, TRAPS, AND OTHER SPECIAL DEVICES CAN BE RELIED UPON ONLY PARTIALLY TO PROTECT AGAINST FOREIGN MATERIALS. SCRUPULOUS CLEANLINESS IN THE INITIAL INSTALLATION WILL AVOID MANY DIFFICULTIES THAT MIGHT OTHERWISE OCCUR DOWNSTREAM FROM THE PROTECTING DEVICES.

MAKE SURE ALL LINES, HOSES, AND FITTINGS ARE CLEAN AND FREE OF SMALL CHIPS AND METAL FILINGS.

CLEAN OUT OF THE FUEL TANK ALL CHIPS, DRILL SHAVINGS, FILINGS, AND OTHER PROCESSING DEBRIS. SUCH MATERIALS ARE A FREQUENT CAUSE OF DRAIN VALVE FOULING. LEAVE PROTECTIVE CAPS, PLUGS, OR COVERS IN PLACE AS LONG AS POSSIBLE. EVEN THEN, STORE FUEL SYSTEM PARTS IN A PLACE SAFE FROM DAMAGE AND AWAY FROM AIRBORNE DUST, FLYING CHIPS, EXCESSIVE MOISTURE, AND THE LIKE. PLUG ALL FUEL LINE OPENINGS ON GLIDER UNITS. (THIS ALSO APPLIES TO VEHICLES THAT ARE TO STAND PARTIALLY COMPLETED FOR ANY LENGTH OF TIME.)

B. FUEL TANK LOCATION:

THE TANK FORE AND AFT LOCATION WITHIN THE BRACKETS IS SPECIFIED BY ENGINEERING, BUT THE FOLLOWING CLEARANCES SHOULD BE CAREFULLY CHECKED AT ASSEMBLY.

1. THE REAR OF THE TANK, INCLUDING FITTINGS AND LINES, MUST NOT EXTEND FURTHER BACK THAN THE FORWARD EDGE OF THE MOUNTING BASE OF THE FORWARD REAR SPRING BRACKET (TO ALLOW PROPER CLEARANCE TO THE PROJECTING ENDS OF THE SPRINGS) AND MUST NOT BE LESS THAN 4.00 INCHES AWAY FROM THE REAR TIRES.
2. CLEARANCE TO ANY NON-MOVING PART SUCH AS BATTERY BOX, TILT PUMP, ETC. TO BE NOT LESS THAN 0.25 INCH. ALL FLUID LINES, WIRES, ETC., ESPECIALLY THOSE WITH EXPOSED METAL ARMOR, ARE TO BE INSTALLED IN SUCH A WAY AS NOT TO BE ABLE TO RUB AGAINST THE TANK.

C. FUEL TANK BRACKET AND BAND:

RUBBER ISOLATORS ARE PLACED BETWEEN THE TANK AND TANK BRACKET, AND BETWEEN THE TANK AND ITS SUPPORTING BAND. THE ISOLATOR ON THE BRACKET IS SHAPED AND PLACED TO COVER JUST THE TANK CONTACT AREA. THE ISOLATOR ON THE BAND EXCEEDS THE BAND SOMEWHAT IN WIDTH AND EXTENDS AT EACH END BEYOND ANY POSSIBLE POINT OF METAL TO METAL CONTACT WITH THE TANK. TO PREVENT THE ENDS OF THE ISOLATOR FROM BECOMING UNSTUCK AND PEELING BACK DUE TO HANDLING, A LENGTH OF MASKING TAPE CAN BE WRAPPED AROUND THEM NEAR THE ENDS; THE TAPE IS THEN REMOVED AT INSTALLATION. NO CEMENT IS USED BETWEEN THE TANK AND THE ISOLATORS WITH THIS METHOD.

OPTIONALLY, THE ISOLATORS MAY BE CEMENTED TO THE BRACKET AND TO THE TANK BAND WITH ADHESIVE 48-00094-951.

(EXCEPTIONS TO THIS SHOP PRACTICE WITH REGARD TO ISOLATORS MAY OCCASIONALLY BE NOTED ON THE SPECIFICATION SHEET.)

B

D. FUEL TANK T-BOLT GUARDS:

THE FOLLOWING CRITERIA PERTAIN TO THE LOCATIONS IN WHICH T-BOLT GUARDS, **ARE NOT REQUIRED.**

1. CONVENTIONALS WITH 27.25 INCH DIAMETER FUEL TANKS AND TANK/FRAME SIDE FAIRINGS.

2. CONVENTIONALS WITH 23 INCH OR 27 INCH DIAMETER FUEL TANKS AND FUEL TANK BRACKET UNDER THE CAB AND/OR SLEEPER BOX.

3. COE'S WITH 23 INCH OR 27.25 INCH DIAMETER FUEL TANKS AND FUEL TANK BRACKET WHICH TIES WITH EXHAUST BRACKET (UNDER EXHAUST ELBOW).

ALL T-BOLTS ARE TO HAVE GUARDS INSTALLED EXCEPT AS NOTED IN D1, D2, AND D3.

COMPILED	TAL	SHOP PRACTICE FUEL TANK ASSEMBLY	SECTION NUMBER 33-03105
APPRV	A Q		
ISSUE DATE	03/21/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-004 FOR FUEL TANK ASSEMBLY.

A. LABEL:

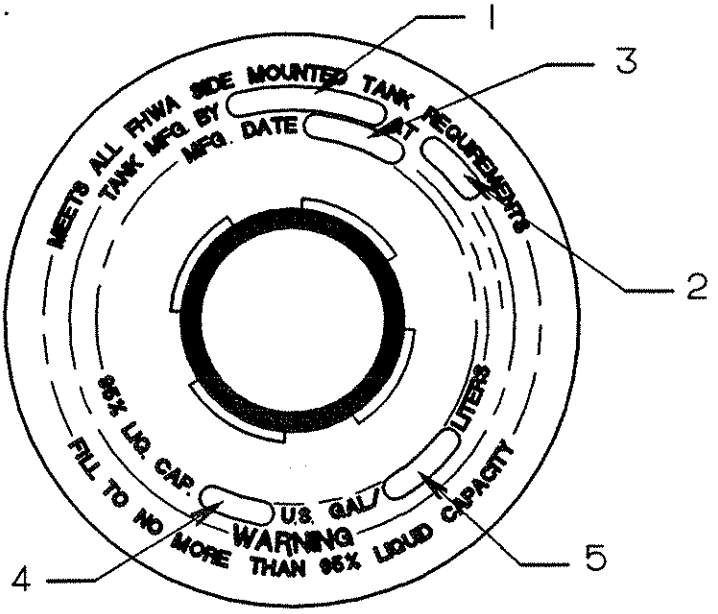
A 24-00278-000 LABEL (ILLUSTRATED BELOW) IS TO BE PLACED ON ALL FUEL TANKS EXCEPT THE FOLLOWING:

1. TANKS EQUIPPED WITH "NON-SKID" MATERIAL.

2. CONVENTIONALS WHERE TANK DOES NOT PROTRUDE PAST BACK OF CAB OR SLEEPER.

THE LABEL IS TO BE LOCATED ON THE TOP OF THE TANK AFTER INSTALLATION. THE FORE/AFT LOCATION IS TO BE CHOSEN TO GIVE CLEAR VISIBILITY WHEN CLIMBING ON AND OFF THE CHASSIS. THE INSTALLATION AREA MUST BE CLEAN AND DRY AT INSTALLATION.

B. FUEL TANK SPECIFICATIONS:



THE FOLLOWING INFORMATION MUST BE PERMANENTLY STAMPED INTO THE FILL NECK COLLAR ON ALL FUEL ON ALL FUEL TANK ASSEMBLIES MANUFACTURED AFTER 7 MARCH, 1989:

1. STAMP NAME OF TANK MANUFACTURER, "FREIGHTLINER".
2. STAMP LOCATION AT WHICH THE TANK IS MANUFACTURED, "PDX" FOR PORTLAND BUILT TANKS, "MTH" FOR TANKS BUILT IN MOUNT HOLLY, ETC.
3. STAMP DATE OF MANUFACTURE, MONTH AND YEAR, E.G. "10-88".
4. TANKS BUILT FOR U.S. VEHICLES ARE TO BE STAMPED WITH THE FUEL CAPACITY STATED IN GALLONS.
5. TANKS BUILT FOR SALE IN CANADA ARE TO BE STAMPED WITH THE FUEL CAPACITY STATED IN LITERS. SEE CONVERSION CHART BELOW:

GALLONS	LITERS	GALLONS	LITERS	GALLONS	LITERS
40	151	80	302	120	454
45	170	85	321	125	473
50	189	90	340	130	492
55	208	95	359	135	511
60	227	100	378	140	530
65	246	105	397	145	548
70	265	110	416	150	567
75	283	115	435		

LOGON ID=

Compiled	F. Freer	SHOP PRACTICE GLIDER PREPARATION	33-03108
Approved	J. LARSON		
Issued	4-4-80		
Revised		Chg Ltr	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

Fuel Lines

All fuel system openings in lines, tanks, etc., are to be sealed with masking tape prior to shipping.

Compiled	T. LESLIE	SHOP PRACTICE FUEL TANK BAND INSPECTION CRITERIA	33-03109
Approved	D. RUUHELA		
Issued	1-6-86		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

The criteria listed below specifies non-acceptable surface flaws for fuel tank bands.

Fuel tank bands exhibiting any of the following criteria are to be rejected:

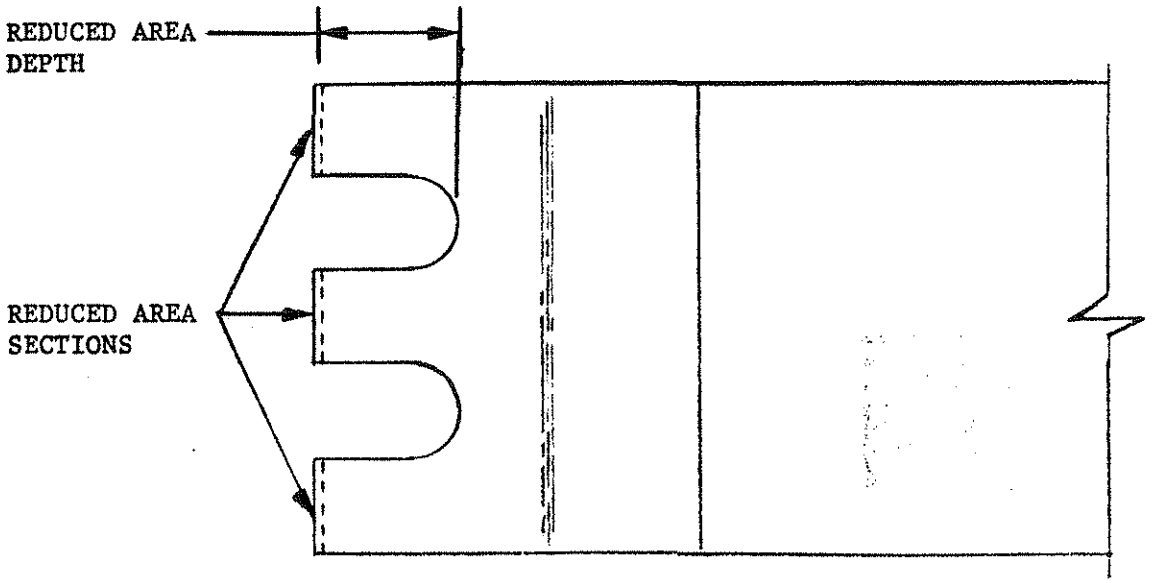
1. Any portion of band showing evidence of cracking at any edge.

2. Band end exhibiting any visible degree of offset produced by mismatched die faces. See Figure 1.

3. Any band end with indentations (penetrating a raised edge burr or the material surface) within any portion of the three reduced area sections. See Figure 2.

FIGURE 1

FIGURE 2



COMPILED	MJC	SHOP PRACTICE FIBER BRAID HOSE WITH CRIMP-ON FITTING	SECTION NUMBER 33-03110
APPRV	J A		
ISSUE DATE	04/09/93		
REV DATE	07/29/96		PAGE 1 OF 1
CHG LTR	A	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-005 FOR FIBER BRAID HOSE W/CRIMP-ON FITTINGS.

COMPILED	MJC	SHOP PRACTICE FIBER BRAID HOSE WITH CRIMP-ON FITTINGS	SECTION NUMBER 33-03110
APPRV	J.ADAMS		
ISSUE DATE	04/09/93		PAGE 1 OF 1
REV DATE		FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	-		PA2101-01

OBJECTIVE

THE PURPOSE OF THIS DOCUMENT IS TO PROVIDE TECHNICAL INSTRUCTION ON THE ASSEMBLY OF PARKER FIBER BRAID HOSE WITH CRIMP FITTINGS.

ASSEMBLY

HOSES ARE TO BE CUT OFF USING PARKER CUT-OFF / MARKING FIXTURE MODEL #TH3-4. (THIS FIXTURE WILL PAINT MARK THE HOSE 1/2" FROM THE CUT END. THE PAINT MARK WILL BE USED LATER TO CHECK THE INSERTION DEPTH OF THE HOSE INTO THE FITTING BARREL.)

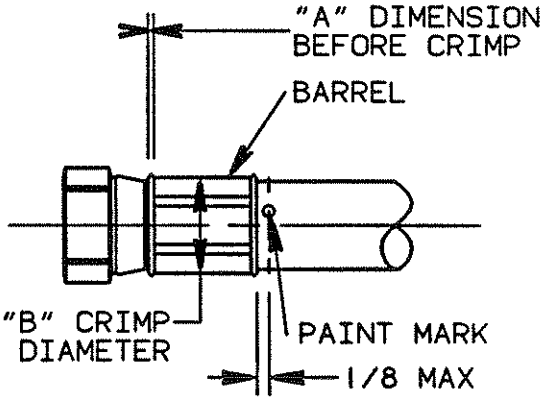
INSERT THE HOSE INTO THE FITTING UNTILL IT BOTTOMS OUT IN THE FITTING. PLACE HOSE ASSEMBLY INTO CRIMP JAWS AND AGAINST BACK STOP,THEN CYCLE CRIMPER.

VISUALLY INSPECT CRIMPED HOSE/FITTING ASSY. THE PAINT MARK SHOULD BE NO MORE THAN 1/8" FROM END OF BARREL, CRIMP RIBS SHOULD BE EVENLY SPACED AND WELL DEFINED, AND THE BARREL MATERIAL SHOULD NOT BE TORN OR DAMAGED.

Q.A. / INSPECTION

THE FINISH DIAMETER OF THE CRIMP SHALL BE CHECKED AGAINST THE CHART BELOW.

SIZE	DASH	A±.02	B±.010
1/4	-4	0.10	.490
3/8	-6	0.13	.610
1/2	-8	0.13	.750



ONCE EACH WEEK, 2 HOSE FITTING ASSEMBLIES WILL BE SAW CUT ALONG THE CENTER AXIS OF THE HOSE THE VERIFY HOSE INSERTION DEPTH. THERE SHALL BE NO MORE THAN A 1/8" GAP BETWEEN THE FITTING AND THE END OF THE HOSE.

.OGON ID=

COMPILED	D B
APPRV	MJC
ISSUE DATE	04/09/93
REV DATE	07/29/96
CHG LTR	A

SHOP PRACTICE

FUEL TANK BUILD-UP PROCESS SUMMARY CHART

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-03111

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-006 FOR FUEL TANK BUILDUP PROCESS SUMMARY CHART.

COMPILED	D.BARLOW
APPRV	MJC
ISSUE DATE	04/09/93
REV DATE	
CHG LTR	-

SHOP PRACTICE

FUEL TANK BUILD-UP PROCESS SUMMARY CHART

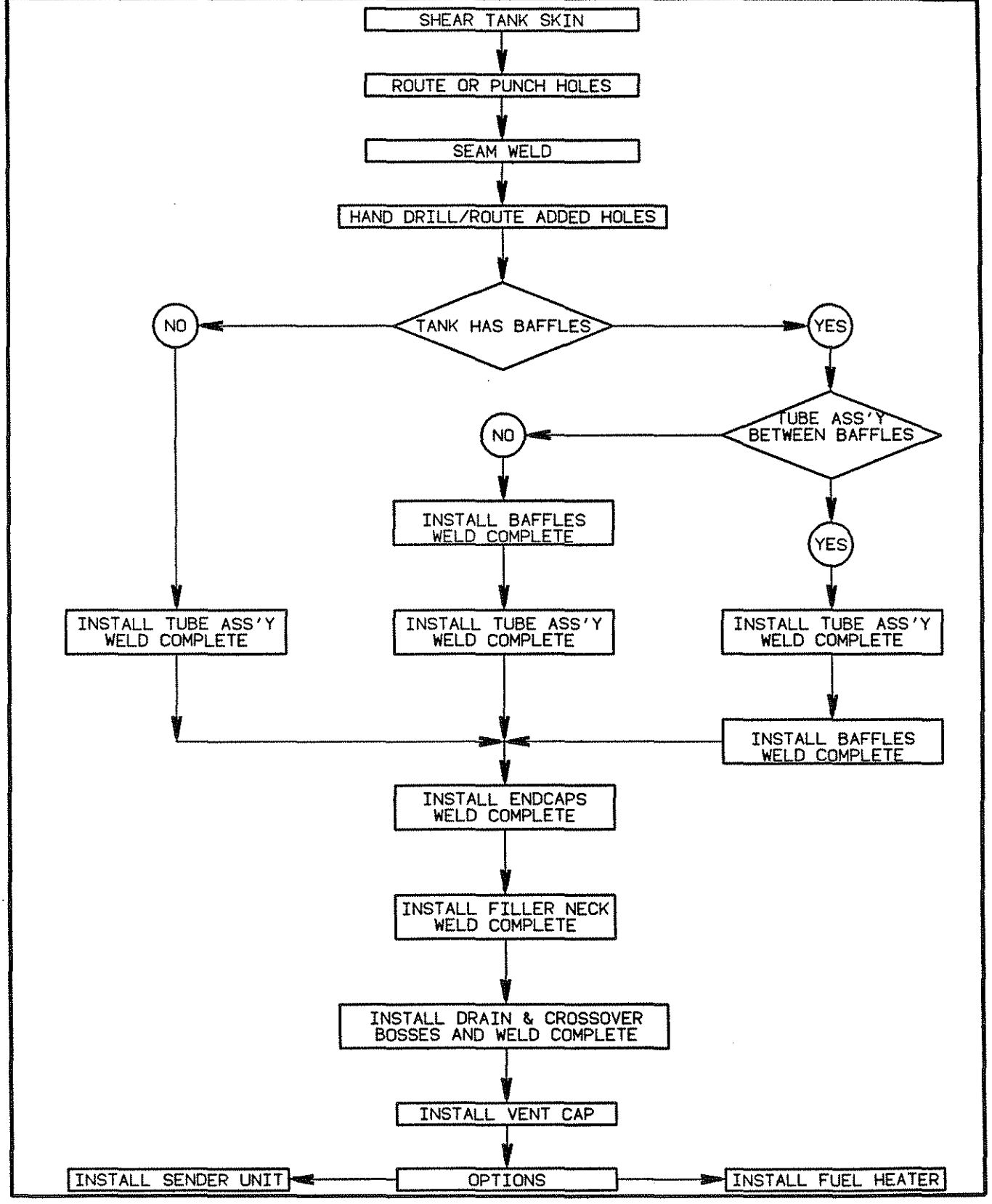
FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-03111

PAGE
1 OF 1

PA2101-01

B



ATE= 4/20/93 TIME=12:18 ACCESS=NONE
OGON ID=

COMPILED	D B	SHOP PRACTICE FUEL TANK BUILD-UP SUCTION/RETURN TUBE INSTALLATION	SECTION NUMBER 33-03112
APPRV	MJC		
ISSUE DATE	04/09/93		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-007 FOR FUEL TANK BUILDUP SUCTION AND RETURN TUBE.

COMPILED	D.BARLOW	SHOP PRACTICE FUEL TANK BUILD-UP SUCTION/RETURN TUBE INSTALLATION	SECTION NUMBER 33-03112
APPRV	MJC		PAGE 1 OF 3
ISSUE DATE	04/09/93	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2101-01
REV DATE			
CHG LTR	-		

B

I. LOCATE AND TACK TUBES

NOTE: ALL WELDING MUST BE DONE IN ACCORDANCE WITH FREIGHTLINER PROCESS SPECIFICATION NUMBER 49-00014

1. REFERENCE PROCESS SUMMARY CHART FOR SEQUENCE OF OPERATIONS
2. INSTALL TUBE ASSEMBLY FROM THE INSIDE OF THE TANK, THROUGH SLOT IN THE SKIN
3. PLACE THE LOCATING SLEEVE AROUND THE SUCTION TUBE (REF. FIG. I)
4. ROTATE TANK SO THAT THE WEIGHT OF THE LOCATOR CAUSES THE TUBE ASS'Y TO REST AGAINIST THE SIDE OF THE TANK (SEE FIG II)
5. POSITION TUBE PLATE IN SLOT

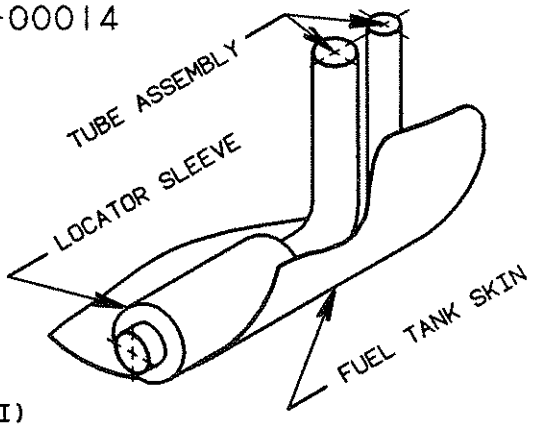


FIGURE I

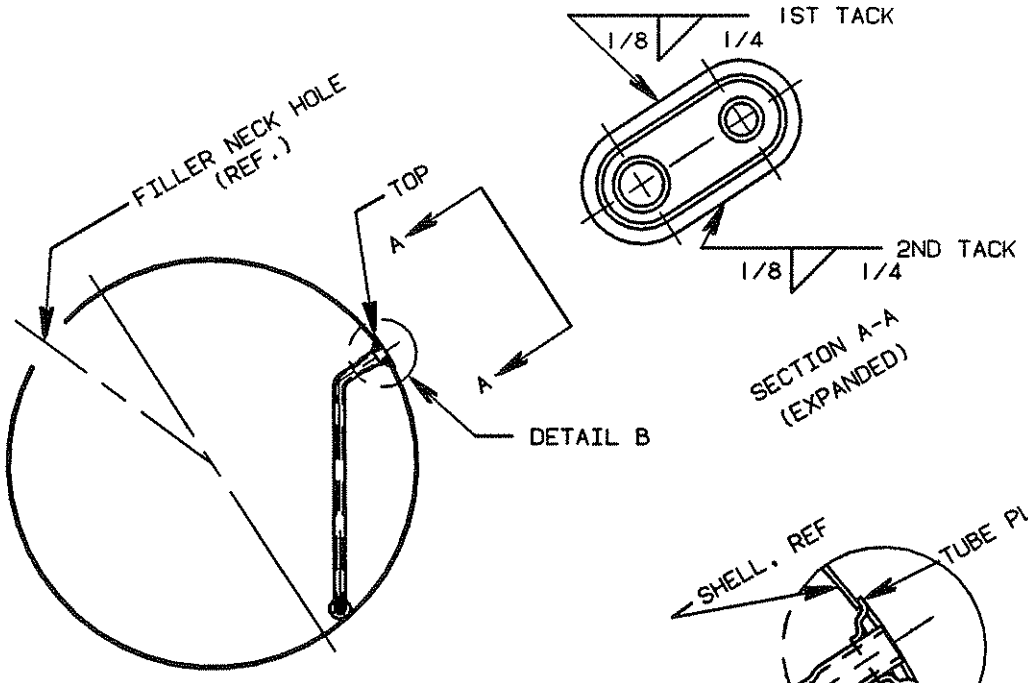


FIGURE II

6. TACK IN PLACE (REF. F/L PROCESS SPEC. 49-00014)
   1/8" FILLET, 1/4" LONG
   TACK TOP FIRST (REF. FIG. II)
   TACK BOTTOM SECOND (REF. FIG. II)

B

II. WELD TUBE PLATE INTO SHELL

NOTE: ALL WELDING MUST BE DONE IN ACCORDANCE WITH FREIGHTLINER PROCESS SPECIFICATION NUMBER 49-00014

1. VISUALLY INSPECT TO INSURE THAT THE TUBE ASSSEMBLY IS ORIENTED PROPERLY RELATIVE TO THE FILLER NECK HOLE
2. ROTATE TANK SO THAT THE WEIGHT OF THE LOCATOR CAUSES THE TUBE ASS'Y TO REST AGAINIST THE SIDE OF THE TANK (REF. FIG. I)
3. WELD TOP OF TUBE PLATE (REF F/L PROCESS SPEC. 49-00014)
   START ON MID-POINT OF PLATE RADIUS
   WELD UP RADIUS, ACROSS PLATE AND HALF WAY DOWN THE RADIUS ON THE OPPOSITE SIDE (REF. FIG. III)
4. VISUALLY INSPECT WELD FOR DEFECTS

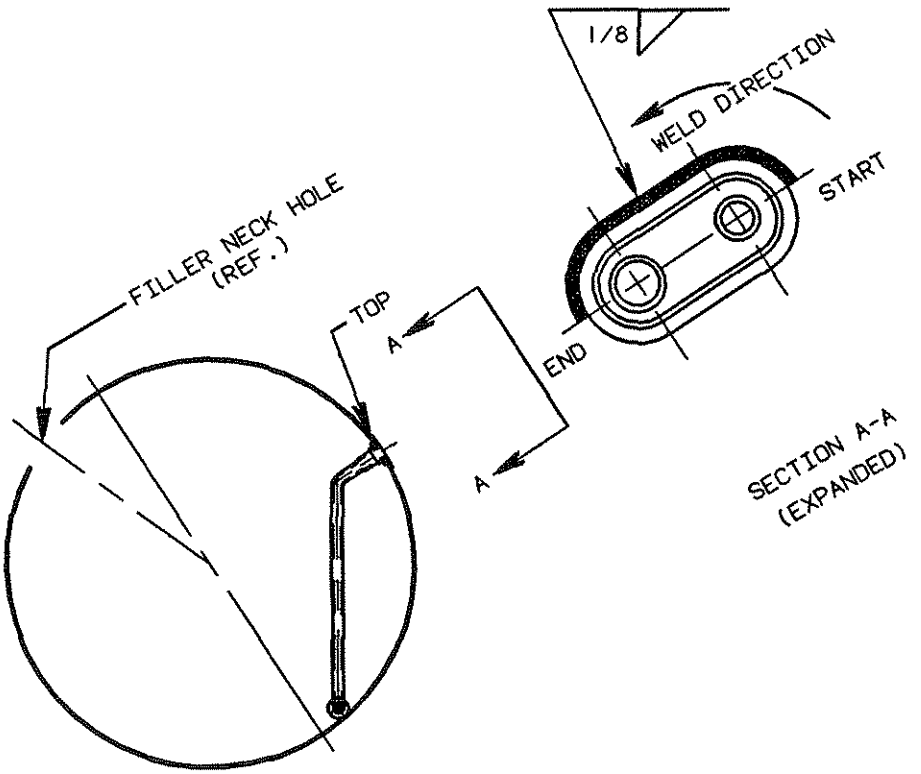


FIGURE III

DATE= 4/20/93 TIME=12:16 ACCESS=NONE
LOGON ID=

B

II. WELD TUBE PLATE INTO SHELL - CONTINUED

5. ROTATE TANK AND POSTION SO THAT THE UNWELDED SECTION OF THE TUBE PLATE IS IN POSTION (REF FIG. IV)

6. WELD UPPER EDGE (WAS LOWER EDGE) (REF. F/L PROCESS SPEC. 49-00014) (REF. FIG. IV)

   START ON MID-POINT OF PLATE RADIUS - START OF THE SECOND WELD SHOULD OVERLAP THE END OF THE FIRST
   WELD UP RADIUS, ACROSS PLATE AND HALF WAY DOWN THE RADIUS ON THE OPPOSITE SIDE - END OF THE SECOND WELD SHOULD OVERLAP THE BEGINNING OF THE FIRST

7. REMOVE LOCATOR SLEEVE

8. VISUALLY INSPECT WELD FOR DEFECTS

9. PROCEED TO NEXT OPERATION (END WELD, OR BAFFLE INSTALLAION SEE PROCESS SUMMARY CHART)

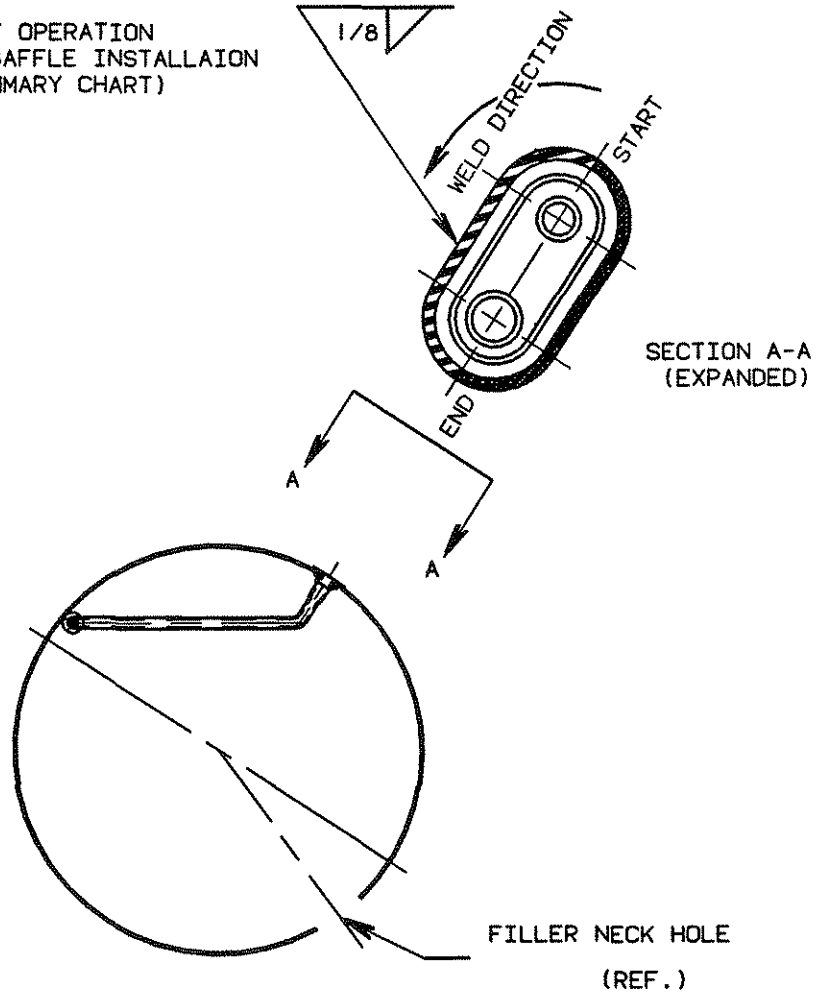


FIGURE IV

DATE= 4/20/93 TIME=12.18 ACCESS=NONE
LOGON ID=

COMPILED	F F	SHOP PRACTICE AIR INTAKE GENERAL REQUIREMENTS	SECTION NUMBER 33-03201
APPRV	DLR		
ISSUE DATE	04/07/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	L		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-008 FOR FUEL AIR INTAKE GENERAL REQUIREMENTS.

Compiled	F. FREER	SHOP PRACTICE	33-03201
Approved	DER	AIR INTAKE, GENERAL	
Issued	4-7-65		
Revised	11-6-87	Chg Ltr J FREIGHTLINER CORPORATION PORTLAND, OREGON	

GENERAL:

To insure that air intake systems are assembled water, and dirt tight, all hose clamps are tightened to 70 - 80 IN/LB. (791-904 N.CM). This is especially true of that portion between the air cleaner and the engine since any foreign material picked up here will go into the engine.

METAL TUBING AND CAST PARTS:

Metal parts used for intake air ducting must be clean and free of burrs before use in an intake system, since costly engine damage can be caused by even a single very small metal particle, or grain of foundry sand.

FINAL CHECK FOR TIGHTNESS:

Air intake systems, when complete on the engine, from the air cleaner to the engine must have all rubber connections checked to insure an air tight condition and that no rubbing occurs between duct and other parts.

Clamp tightening torque will reduce to 45-50 in/lb in about 24 hours due to relaxation of elastomeric components. Retightening to the original torque is not necessary unless the torque drops below 45 in/lb.

COMPILED	BAROUDI	SHOP PRACTICE BREAKING AIR INSTALLATION	SECTION NUMBER 33-03202
APPRV	BAROUDI		
ISSUE DATE	06/28/81		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-009 FOR BREAKING AIR INSTALLATION.

Compiled	Baroudi	SHOP PRACTICE BREAKING AIR INSTALLATIONS	33-03202
Approved	[illegible]		
Issued	6-28-81		
Revised	10-30-81	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1 of 2

A ↓

A. Application of Parts to Cab

All cab mounted air intake parts to be assembled prior to mounting cab to chassis.

Rivet tube adapters to deck and apply sealing compound (48-0094-510) around tube at deck area and all around snorkel to cab on the outside. Clamp rubber connector to lower end of deck tube adapter.

Assemble rubber elbows and tubes and attach bonnet to snorkel.

B. Cleaner Adjustment

Cleaner should be mounted to frame rail prior to chassis paint section. After cab is mounted to chassis, check for concentricity within .50 inches between adapter/rubber connector and the air cleaner inlet.

If cleaner adjustment is needed:

- Cleaner bracket slots provide .50 inch forward and aft movement of cleaner.

- Cleaner may be moved in and outboard of rail using .25 inch spacers.

C. Cab Lock U-Bolt Adjustments

The cab lock U-bolt plays an important part in assuring proper seal of the breaking rubber connector as it prevents the rubber connector from rising off the air cleaner by limiting the upward travel of the cab to 3/4 inch. To adjust these U-bolts, do the following:

1. Lock cab in down position.

2. With cab locks in locked position, raise cab until cab lock U-bolt springs are completely compressed.

3. Measure distance between the rubber cab mount and the rubber mount seat (see Figure 1). This distance should be no more than 3/4 inch. More tension must be applied on the cab lock U-bolt springs if this measurement is more than 3/4 inch. If the measurement is less than 3/4 inch, reduce the tension on the U-bolt springs.

C. CAB LOCK U-BOLT ADJUSTMENTS, CONTINUED

With cab in this position, check for firm contact of rubber boot all around the top cover of the cleaner. With rubber connector compressed, distance should be 5.00 in. between the cab deck and the top cover of the cleaner. If necessary, move cleaner upward to assure proper contact. Shims (11-9531 and/or 18-9710) may also be used under rubber cab mount. U-bolt adjustment should be made after shims are installed.

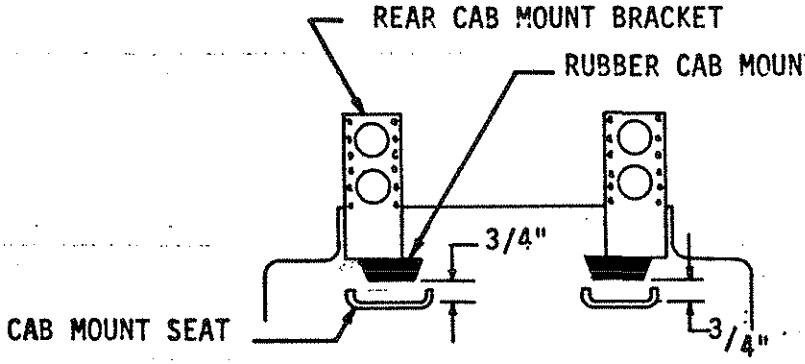


Fig. 1

Compiled	BAROUDI	SHOP PRACTICE	33-03203
Approved	[signature]	AIR CLEANER INSTALLATION, FARR	
Issued	11-17-67	Chg Ltr D **FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 1
Revised	2-17-82		

FARR AIR CLEANER

A. Pamic Cartridge Installation

When installing the Pamic cartridge into its housing, observe the following procedure:

1. Hold the cartridge with a "bowling ball grip" (that is, fingers in the flange supported ends of the tubes, as shown in the sketch).

2. Insert carefully so as not to hit the tubes against the sealing flange edges of the housing.

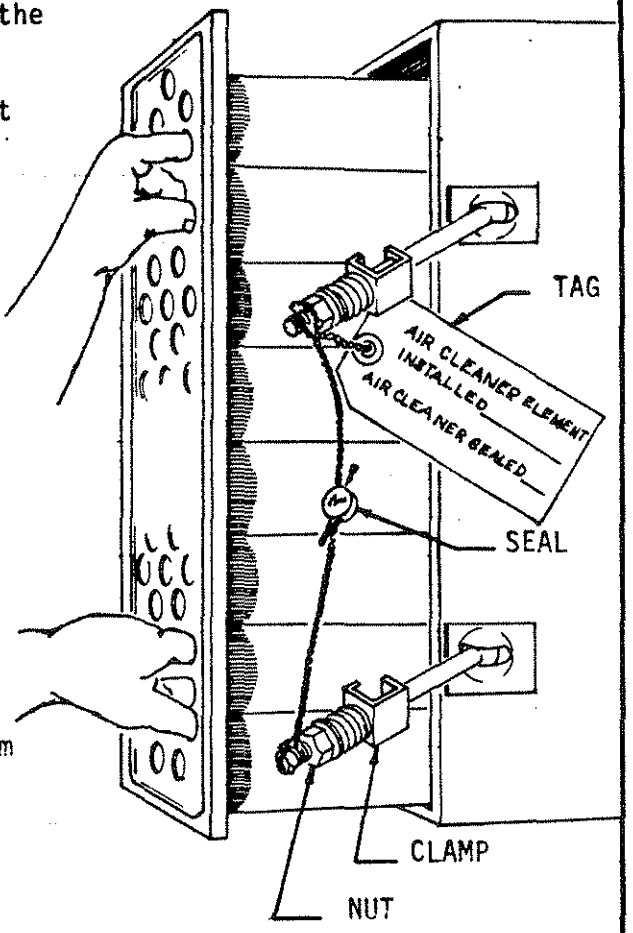
3. Seat cartridge carefully by pressing edges into snug contact all around the sealing flange. DO NOT PUNCH OR POUND CENTER OF CARTRIDGE.

4. Install moisture eliminator (and rain guard or adapter).

5. Draw all retaining nuts down evenly all around, criss-crossing from corner to corner. Tighten nuts as far as possible by hand, then take up to 60 - 80 in.-lb. torque.

6. Before releasing the vehicle from the shop Inspection will install a metal wire seal between both pairs of nuts on opposite sides of the housing. (See Sketch)

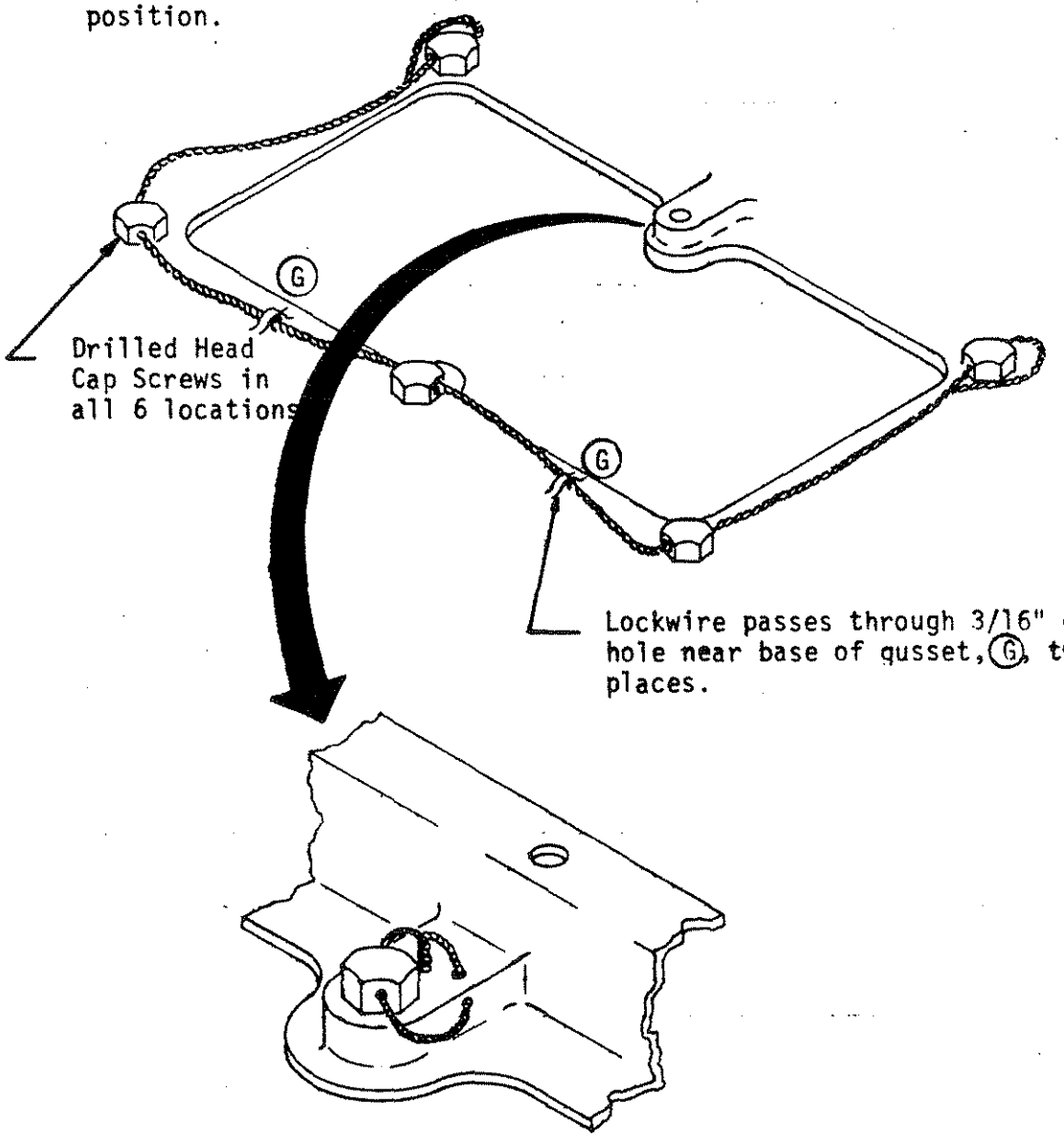
7. Inspection will also attach to one of the nuts a tag bearing date of installation of filter element and date of sealing the air cleaner. (See Sketch)



B

B. DDE 8V-71 Shut Down Adapters with Top Mount Farr Cleaner

1. Tighten the 6 cap screws which mount the adapter (shut-down assembly) to the blower housing to 16 to 20 ft-lb. torque.
2. Lockwire as shown below, routing the wire carefully to clear all action of the shut down plate as it moves into and out of closed position.



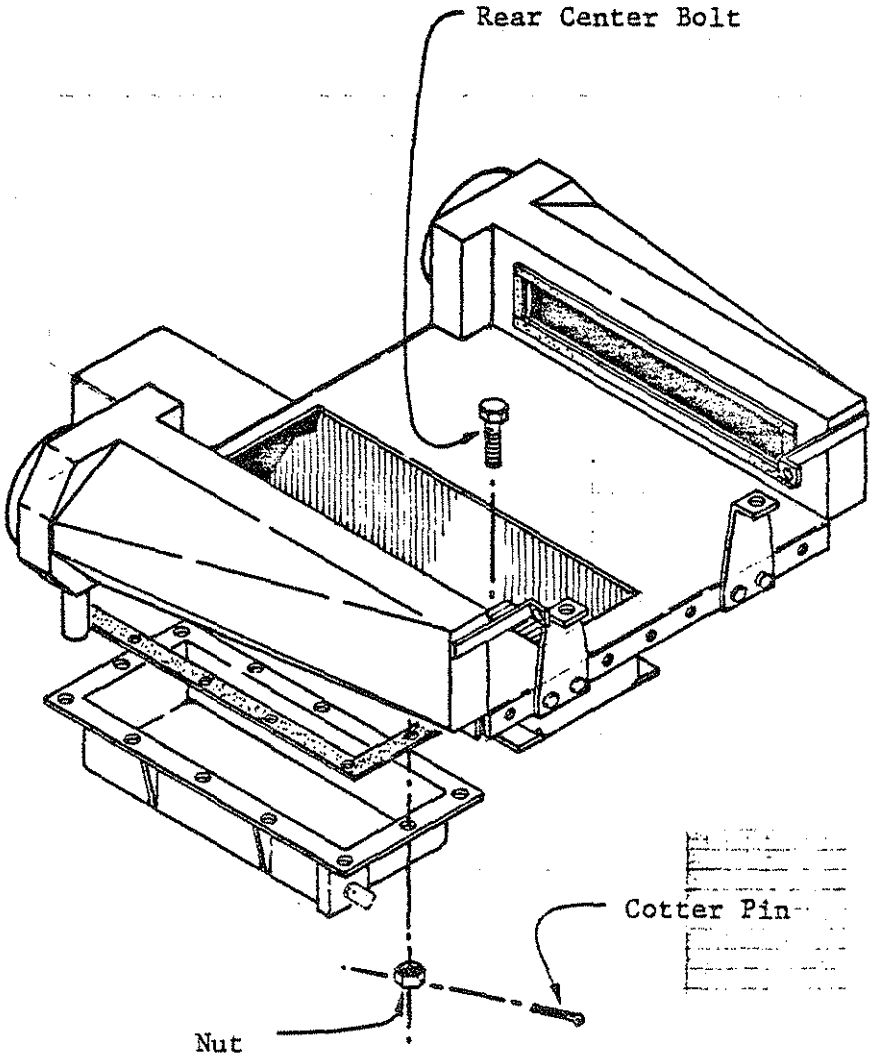
C. 8V-92N DYNACELL INSTALLATION

1. Mount cleaner to intake adapter, using proper gasket, and insuring that all bolts are tight, approximate 24 FT LB.

2. Pay close attention to the rear center bolt and install as shown below. Pre - Drill hole in bolt and install cotter pin after nut has been tightened as described above. This will prevent any possible change of engine damage due to the bolt working loose and going into the blower, or preventing the shut down from working.

3. Insure that All adapter bolts are tight to prevent engine damage due to dust enterance.

4. Install element and complete the assembly.



OBSOLETE - SAVE

Compiled	McINTOSH	SHOP PRACTICE INTAKE AIR RESTRICTION INDICATOR (OR GAUGE) INSTALLATION	33-03204
Approved	BRISTOW		
Issued	9/10/73	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised	A-4-80		

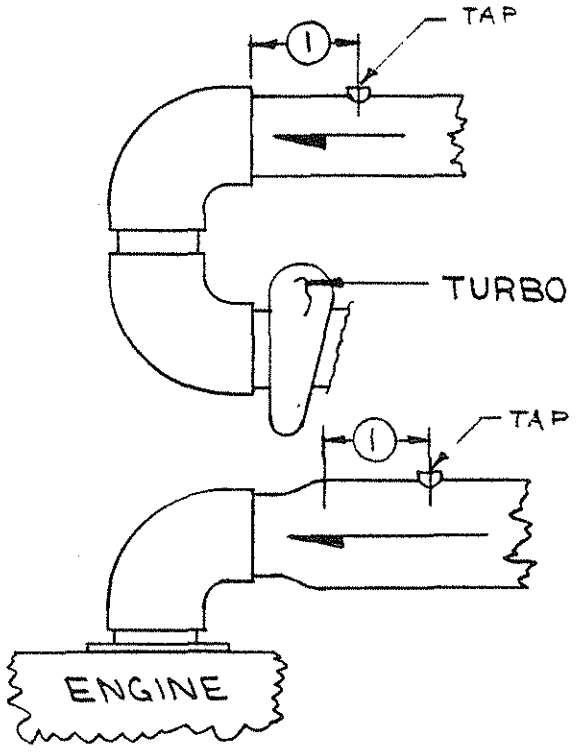
SENSING TAP LOCATION

The sensing tap for the air restriction indicator or gauge (whichever used), should always be located in a straight section of pipe at least one pipe diameter away from any bends, elbows or reducers (See sketch). The straight section should be chosen as close as possible to the engine manifold, blower or turbocharger inlet. Such location provides restriction readings most typical of the entire system.

A

If the intake system will not allow the above requirements, the restriction tap should be located on the air cleaner outlet. If the restriction tap is mounted on the cleaner, the setting on the indicator should be selected to show the need for service before the maximum system restriction is exceeded.

B



B

NOTE: A dimension to be equal to or greater than the intake tube diameter.

Compiled	F.Freer	SHOP PRACTICE LUBRICANT, WET CLEANERS	33-03205
Approved	DAC		
Issued	5-20-74		
Revised	4-4-80	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	

Oil Bath (Wet) Cleaners

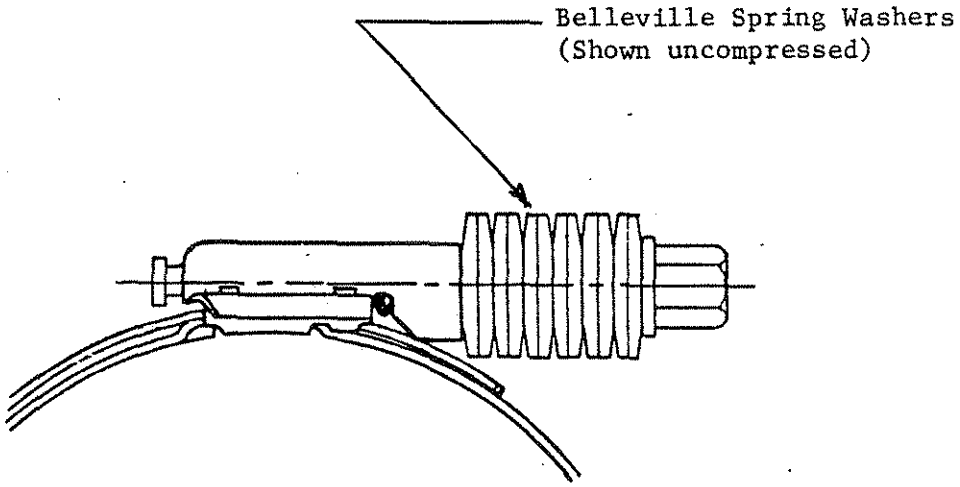
The cleaner is to be filled as denoted on the lubrication chart (Form E54) latest revision.

Compiled	S.J.H.	SHOP PRACTICE	
Approved	HEILESON	CONSTANT - TORQUE CLAMPS	33-03206
Issued	12-10-85		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

INSTALLATION OF CONSTANT - TORQUE CLAMPS USED ON CHARGE AIR COOLER PLUMBING:

- Torque clamps at initial installation to 125 inch lbs. or until Belleville Spring Washers are compressed/flattened.

- Torque loss from rubber hose compression ("Cold Flow") after initial installation will leave clamp torque at 90 - 100 inch lbs.



Compiled	A. ROBERTS	SHOP PRACTICE AIR CLEANERS WITH REMOVABLE ELEMENT	33-03207
Approved			
Issued	4-4-80		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

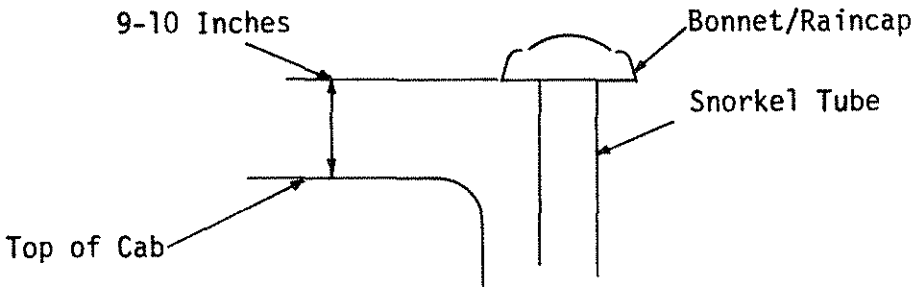
1. Before releasing the vehicle from the shop, inspection will install a metal wire seal (if none present) on all air cleaners with removable elements. This seal will be installed in such a manner to prevent disassembly and removal of the element without seal breakage.

2. Inspection will also attach a tag bearing date of installation of filter element and date of sealing the air cleaner.

Compiled	F. Freer	SHOP PRACTICE	33-03208
Approved	JLR	STATIONARY AIR INSTALLATION	
Issued	4-4-80		
Revised	4-15-83	Chg Ltr B	FREIGHTLINER CORPORATION PORTLAND, OREGON

Bonnet to Roof Clearance

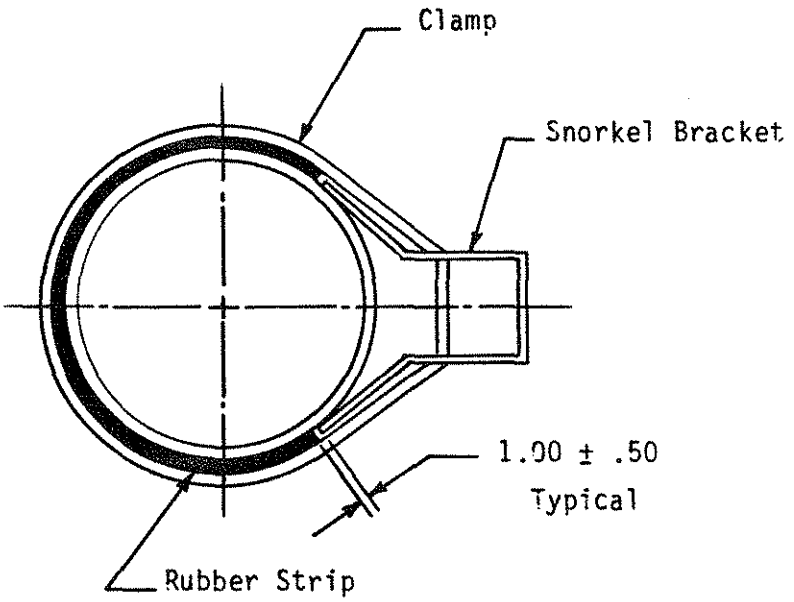
Unless specified otherwise on the chassis spec sheet, the bonnet location should be set as shown:



CLAMP RUBBER STRIP INSTALLATIONS

All rubber strips used with Snorkel Brackets should be installed as shown:

B



Compiled	F. Freer	SHOP PRACTICE REWORKED CLEANERS	33-03209
Approved	[signature]		
Issued	4-4-80		
Revised	10-1-82	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	

Reworked Components

Air cleaners are not to be reworked unless directed as such on an approved Engineering drawing.

All reworking to air cleaner inlet and outlet tubes must be accomplished in such a fashion as to minimize restriction to the air flow through the cleaner. Any portion of the tube(s) extending into the air cleaner body after welding, must be removed.

A All reworked air cleaners and other components of air intake system must be checked for weld slag and other foreign matter and after rework is complete, the air cleaner interiors should be primed or painted to prevent rust formation.
B All reworked air cleaners must be pressure tested at 5 to 7 psi to ensure an air tight seal on the outlet side. Apply inspection decal (Ref. 03-10286) on cleaner adjacent to manufacturer identification.

COMPILED	F F	SHOP PRACTICE HOSE HANGERS	SECTION NUMBER 33-03210
APPRV	F F		
ISSUE DATE	04/04/80		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-010 FOR HOSE HANGERS.

Compiled	F. Freer	SHOP PRACTICE HOSE HANGERS	33-03210
Approved	DLR		
Issued	4-4-80		
Revised		Chg Ltr	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

A. Cross Brace Mounted

When hose hangers are mounted to the horizontal cross braces, the cross brace is to be installed with the flanges facing forward. This will prevent chafing of the airlines and light cable.

B. Center Mount Snorkel

Vehicles with center mounted snorkel are to have the hose hanger hasp (Ref. 22-10198) located on the snorkel bracket rather than its normal cab location.

COMPILED	F. F	SHOP PRACTICE INTAKE DUCT INSTALLATION	SECTION NUMBER 33-03211
APPRV	F. F		
ISSUE DATE	04/04/80		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-011 FOR AIR INTAKE DUCT INSTALLATION.

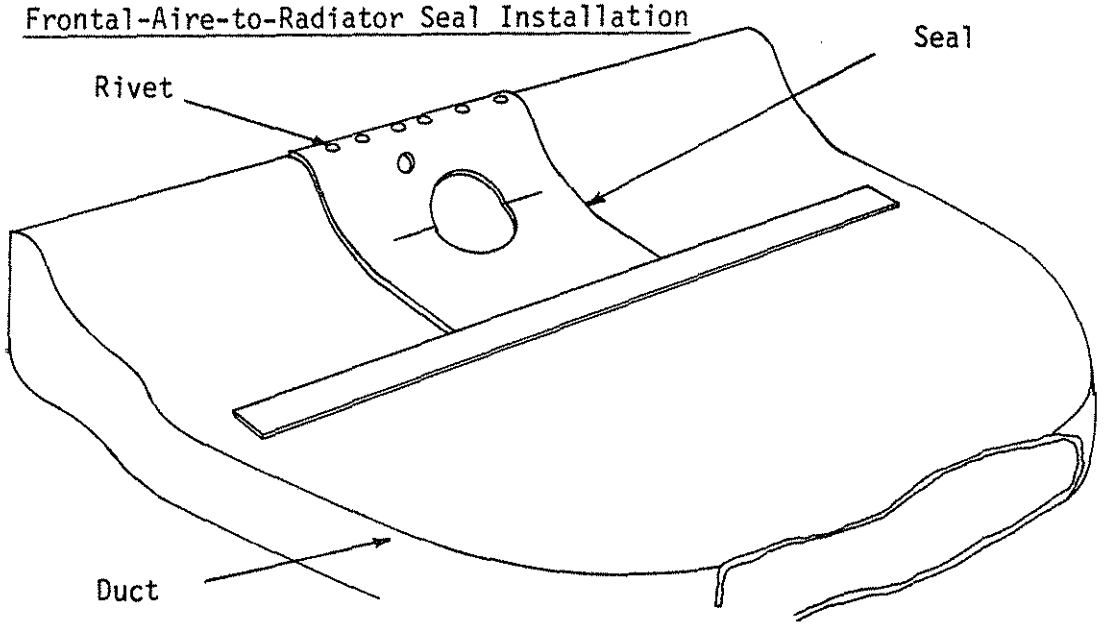
Compiled	F. Freer	SHOP PRACTICE INTAKE DUCT INSTALLATION	33-03211
Approved	[illegible]		
Issued	4-1-80		
Revised	10-30-81	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

A. Frontal-Aire Duct Through Cab Nose Skin

The frontal aire duct, when fully installed, must extend through the nose skin .75± .25 inches, all the way around the duct, and make contact with the wiper seal all around the duct surface for a positive seal at all points. Cut off the front portion of the duct as necessary to get correct protrusion and seal. Adjust duct height, using duct positioners, so the duct is centered in the wiper seal.

A

C. Frontal-Aire-to-Radiator Seal Installation



For a successful bond of the neoprene seal (Ref 03-10984) to the "Frontal Aire" duct, follow these steps:

1. Thoroughly stir adhesive prior to use.

2. Thoroughly clean surfaces to be bonded.

3. Spread one coat of adhesive on both the seal and the Frontal Aire duct on the surfaces to be bonded. Entire bond surface is to have a thin film of adhesive.

4. Allow adhesive to become tack dry, (when the surface may be touched lightly with the finger without sticking). This will require at least 25 minutes at 68° F.

5. Apply a second coat of adhesive to both surfaces and immediately assembly the seal to the duct. Apply a slight pressure for a few moments until the bond will hold by itself.

In addition to adhesive bonding, install a row of four rivets (Ref. AD45 ABS/ or BS Pop Rivet) to help retain the forward lip of the seal.

COMPILED	F F	SHOP PRACTICE AIR INTAKE PIPING INSTALLATION	SECTION NUMBER 33-03212
APPRV	DCR		
ISSUE DATE	04/04/80		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0003-012 FOR AIR INTAKE PIPING INSTALLATION.

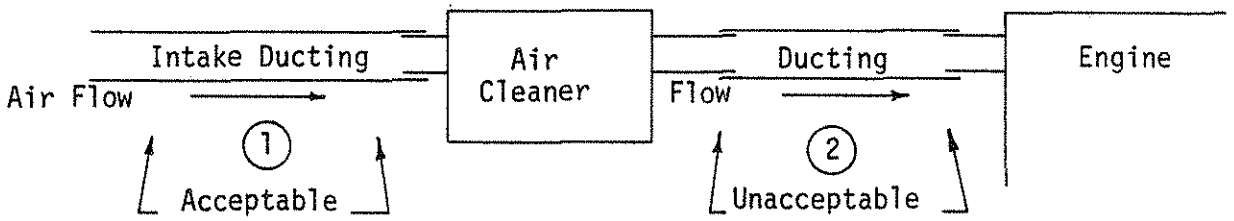
Compiled	F. Freer	SHOP PRACTICE AIR INTAKE PIPING INSTALLATION	33-03212
Approved	DCR		
Issued	4-4-80		
Revised		Chg Ltr	FREIGHTLINER CORPORATION PORTLAND, OREGON

Tubing Protection Against Chafing

By means of careful routing and firm clamping, all intake air ducts must be protected from any possible chafing against adjacent parts. Firm support and allowing adequate cleanrance provide the best protection and should be used, when possible, avoid possible shifting into contact.

Bonded Tube or Fittings

Rubber (or neoprene) ducting or elbows, etc., that have been enlarged, extended or otherwise modified by bonding after original moulding, will not be acceptable for installation in any portion of the ducting or the clean side (2) of the air cleaner. Use of such parts upstream of the air cleaner (1) is acceptable, however.



Compiled	Baroudi	SHOP PRACTICE COWL MOUNTED CLEANERS	33-03213
Approved			
Issued	10-30-81		
Revised		Chg Ltr	P*A078-30

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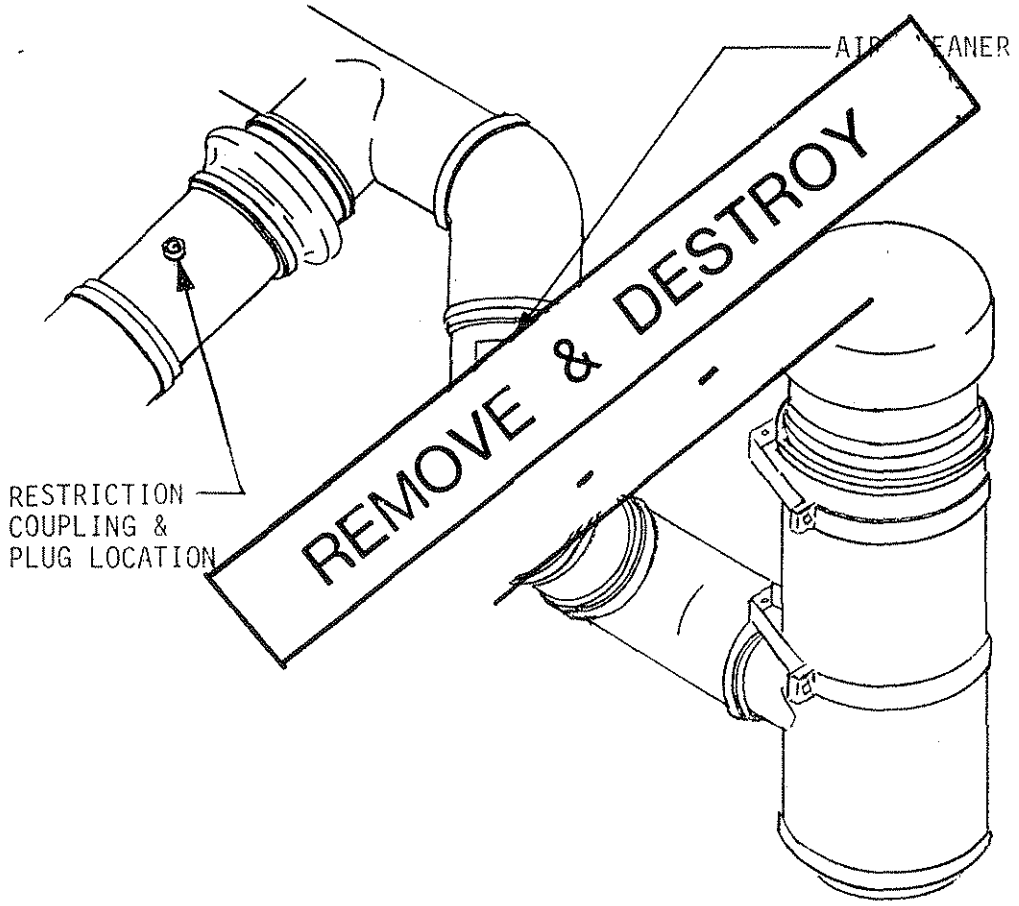
PORTLAND, OREGON

A. VENDOR DECAL INSTALLATION

Conventional vehicles with cowl side mounted air cleaners, single and dual systems, are to have the air cleaner decals mounted on the ducting between the air cleaner and the engine turbo where they are most legible as shown below.



B. RESTRICTION PLUG INSTALLATION

When the restriction gauge is not used, plug the coupling of the tube using 23-9270-002.

Compiled	H.J.R.	SHOP PRACTICE FUEL SYSTEM PREPARATION FOR SHIPPING GLIDER KIT	33-03501
Approved	[signature]		
Issued	6-23-69	Chg Ltr	
Revised		FREIGHTLINER CORPORATION PORTLAND, OREGON	

Seal off with masking tape all fuel line and other openings in the system when fuel tanks, etc., are included in a Glider Kit.

Compiled	F.FREER	SHOP PRACTICE EXHAUST, CONTENTS	33-04100
Approved			
Issued	04/07/65		PG 1 OF 1
Revised	02/04/91	Chg Ltr K FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2024-62

PRACTICE NO.	DESCRIPTION
33-04101	EXHAUST HEAT PROTECTION
33-04102	EXHAUST PIPE INSTALLATION
33-04103	EXHAUST ADJUSTMENT
33-04107	EXHAUST CLAMP INSTALLATION
33-04110	EXHAUST STACK HEIGHT

REFERENCES:

Turboconveyor Warning 33-01120

ORIGINAL

COMPILED	HJR	SHOP PRACTICE PROTECTION OF PARTS FROM EXHAUST HEAT	SECTION NUMBER 33-04101
APPRV	UVS		
ISSUE DATE	04/07/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0004-001 FOR EXHAUST HEAT PROTECTION.

Compiled	H.J.R.	SHOP PRACTICE PROTECTION OF PARTS FROM EXHAUST HEAT	33-04101
Approved	U.V.S.		
Issued	4-7-65		
Revised	10-21-86	Chg Ltr D FREIGHTLINER CORPORATION PORTLAND, OREGON	

A. GENERAL

There are many parts of the truck which are vulnerable to damage or deterioration from excessive heat. Mainly, flexible rubber hoses and valves having rubber O-rings in them are the parts most susceptible to heat damage. Painted surfaces are also vulnerable.

Since the exhaust system is an extremely high source of heat to its surroundings, care must be taken to avoid locating heat sensitive parts close to hot pipes and mufflers. If such is unavoidable, then some means must be provided to protect these parts from heat.

Many times the exhaust system must be routed from the engine after everything else is already in place on the truck. After the system has been installed, the following provisions for heat protection should be taken:

1. Relocation

Wherever possible, move rubber hoses, rubber parts, or rubber containing valves to a distance of at least 6 inches from any hot surface. Especially try to keep these parts from being located directly above the heat source.

2. Heat Shield

Where relocation is not practical, insert a heat shield, preferably of aluminum, between the hot surface and the sensitive part so that an air gap exists on both sides of the shield. The shield should be attached to a "cold" object rather than to the exhaust pipe itself.

If the shield must be attached to the exhaust pipe, use exhaust clamps to attach the shield to the pipe. Do not weld any shield brackets to the exhaust pipe.

(1) This applies to parts up to 4 inches from hot surfaces. Parts that are 4 to 6 inches from hot surfaces require Engineering review.

3. Insulation of Pipe

If neither of the above solutions is possible, the exhaust pipe can be covered with insulating wrap. This can be clamped to the pipe with hose clamps. This method should be used only when less than 2 inches of space exists between the hot surface and the sensitive part.

4. Change to Metal Lines

Copper or aluminum tubing can sometimes substitute for rubber flexible lines, at least in the area close to exhaust pipes and manifolds.

COMPILED	BRISTOW	SHOP PRACTICE EXHAUST PIPE INSTALLATION	SECTION NUMBER 33-04102
APPRV	BRISTOW		
ISSUE DATE	03/21/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0004-002 FOR EXHAUST PIPE INSTALLATION.

A. HINGED TOP OF EXHAUST STACK

When installing a detachable or hinged upper stack, the short end is to be down, so that maximum clearance above the vehicle will be gained. (See Figure 1.)

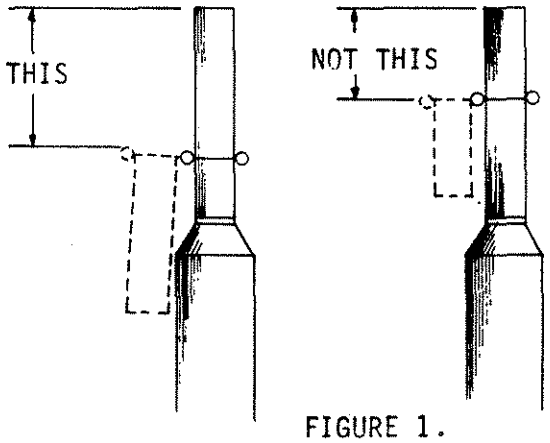


FIGURE 1.

B. WEATHER CAP

Install the exhaust weather cap with the hinge on the inboard side of the vehicle, as shown in Figure 2.

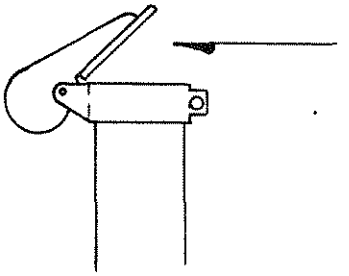


FIGURE 2.

C. Painting

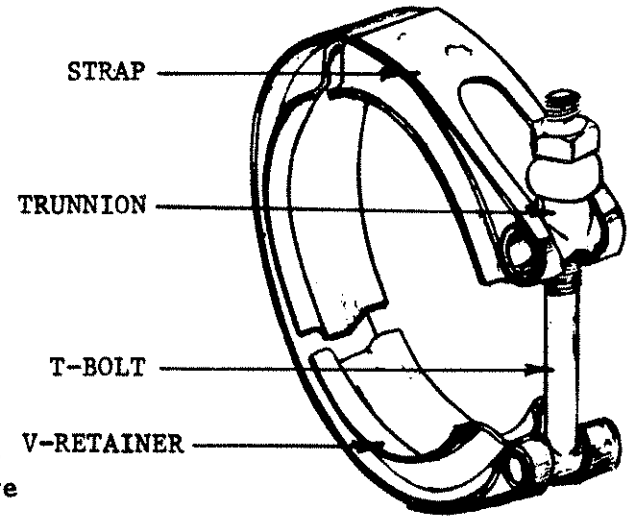
The manifold elbow and lower elbow are to be painted with high temparature heat resistant aluminum paint. (For suitable paints of this type see Freightliner Materials Specification 48-00113.)

D. U-Bolt Clamps

For safety, and for trailer swing and other clearances, turn all U-Bolt clamp ends downward or inward if possible.

E. V-Band Couplings

Proper installation of V-Band couplings involves several simple but important steps, none of which may safely be omitted:



1. Be sure coupling is the proper one for the application. Compare part number on the coupling and part number on the parts list.

2. Be sure the flanges seat properly without misalignment, offset or gaps before installing the coupling.

3. Spread coupling as little as possible at installation. Preferably, slip coupling over the end of one tube before flanges are seated.

4. After V-Band coupling has been positioned and is seating properly all around, tighten nuts to about 70% of specified torque: (See table below.)

5. Finally tap around the outside of the coupling with a rubber or a plastic mallet to distribute band tension and tighten to specified torque value. Do not overtorque.

TABLE

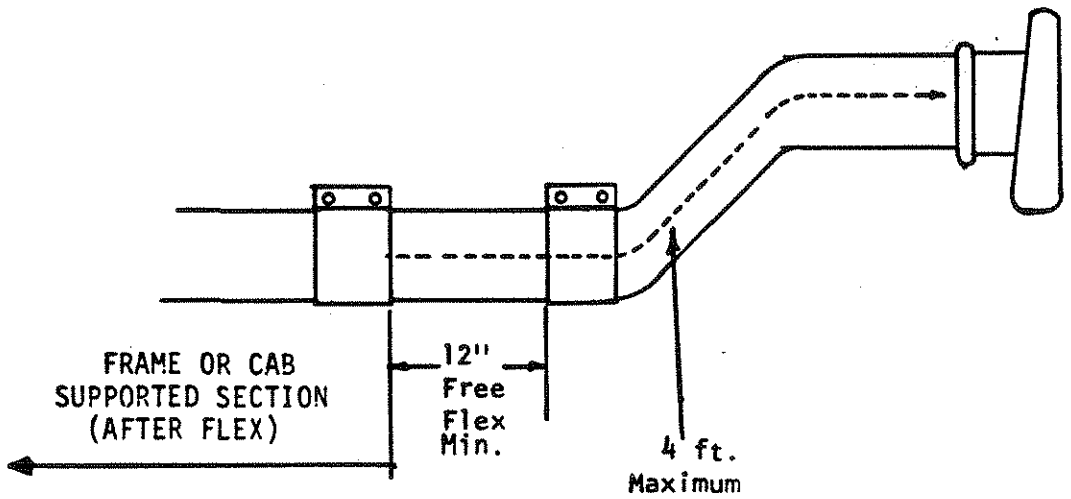
COUPLING (F/L No.)	THREAD SAE	TORQUE (LB-FT) MAX.	TORQUE (LB-FT) 70% of MAX.
01-11536	5/16 - 24	15.0	10½
01-14551	1/4 - 28	8.0	5.6
01-14596	1/4 - 28	8.0	5.6

G. Flexible Connection

The minimum length of flex tube is at least 12 inch lengths when used to provide flexibility for engine torquing and frame rail racking. This length is measured between the pipes and does not include overlap. Overlap should be a minimum of 1 inch. Approval for shorter lengths should be obtained from Engineering.

Flex tube must be used somewhere between the exhaust mainfold and any pipe that is supported by the frame or cab. It must also be used between any two pieces of pipe when either pipe is supported by the transmission, cab or frame.

On both 4-inch and 5-inch systems, install flex tube as close to the turbo as possible to prevent excessive loading of the turbo charger housing. The point at which this flex connection attaches to the first frame or cab mounted section of the exhaust plumbing must not exceed four feet.



When flex tube is installed to provide for heat expansion only, minimum flex length can be 5 inches between the pipe ends.

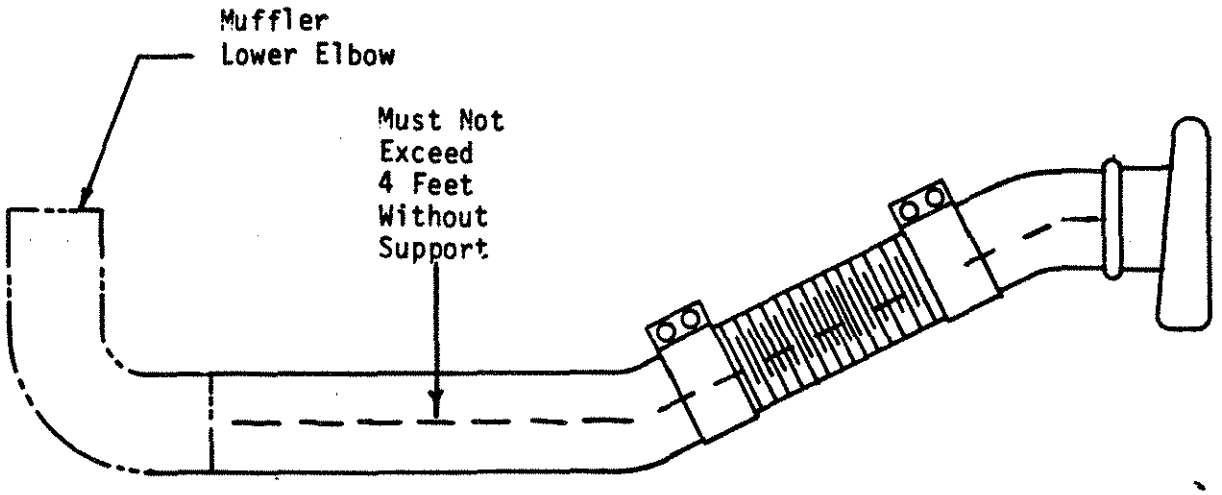
H. Exhaust Pipe/Fuel Tank Clearance

Minimum acceptable clearance between the fuel tank and any portion of the exhaust pipe or muffler is 1.00 inch.

J. EXHAUST ROUTING SUPPORT

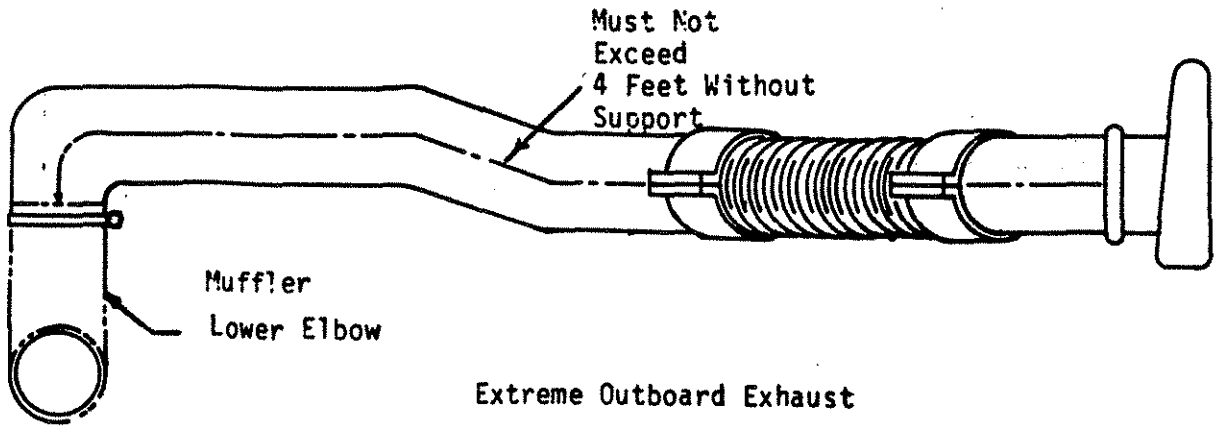
An exhaust support must be used when the total length between the turbo-exhaust connection and lower elbow inlet, measured along the center line of exhaust tubing, exceeds 4 feet.

The support brk't is to be either frame or cab mounted and located on the downstream side of the first flex connection.



Outboard Exhaust

(Side View)



Extreme Outboard Exhaust

(Top View)

COMPILED	SCHMITT	SHOP PRACTICE MUFFLER ADJUSTMENT BREAKING SYSTEM	SECTION NUMBER 33-04103
APPRV	BRAY		
ISSUE DATE	09/29/69		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0004-003 FOR MUFFLER ADJUST.BREAKING SYSTEM.

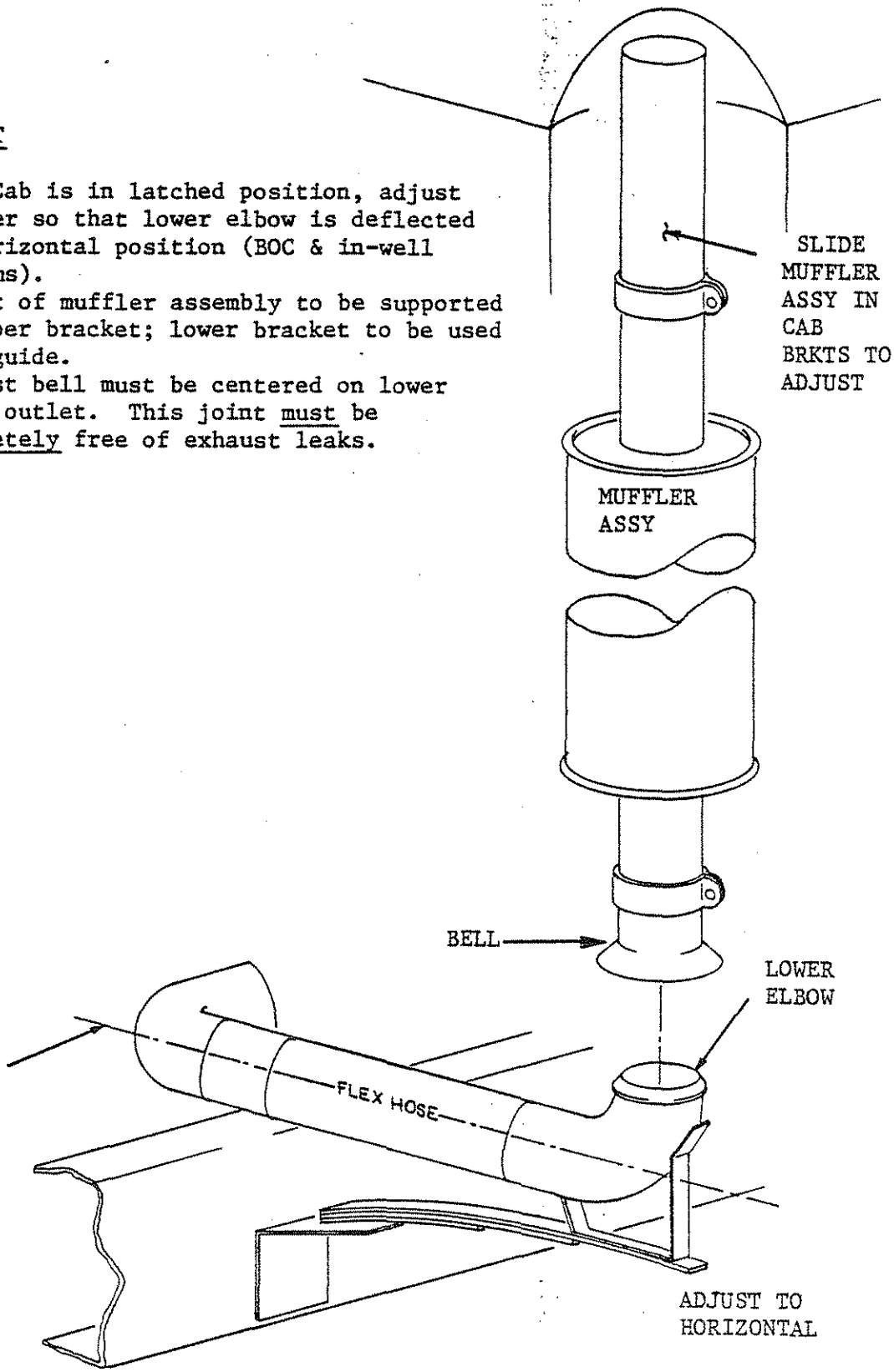
Compiled	SCHMITT	SHOP PRACTICE MUFFLER ADJUSTMENT BREAKING SYSTEM	33-04103
Approved	BRAY		
Issued	9-29-69		
Revised	12-16-77	Chg Ltr B	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

B

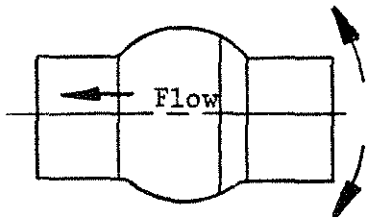
MUFFLER ADJUSTMENT

1. When Cab is in latched position, adjust muffler so that lower elbow is deflected to horizontal position (BOC & in-well systems).
2. Weight of muffler assembly to be supported on upper bracket; lower bracket to be used as a guide.
3. Exhaust bell must be centered on lower elbow outlet. This joint must be completely free of exhaust leaks.

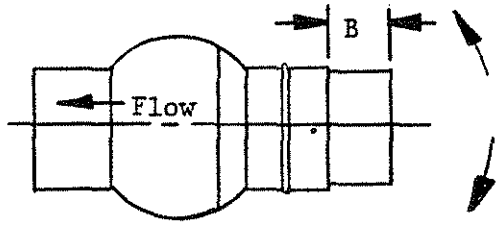


Compiled	C. JARED	SHOP PRACTICE EXHAUST BALLJOINT INSTALLATION AMPCO	33-04106
Approved	Ruuhela TO		
Issued	4-11-79	Chg Ltr	
Revised		FREIGHTLINER CORPORATION PORTLAND, OREGON	

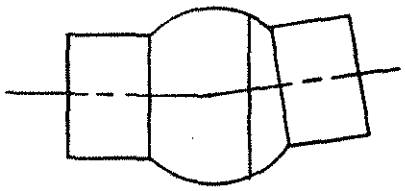
AMPCO BALLJOINTS



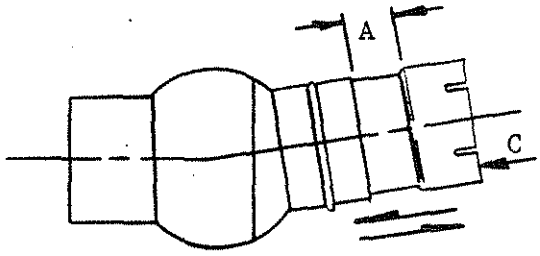
REF: 4SN or 5SN



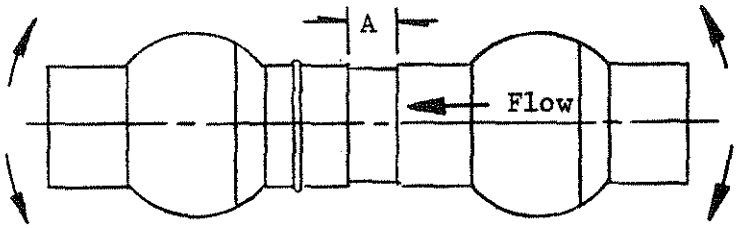
REF; 4SRN or 5SRN



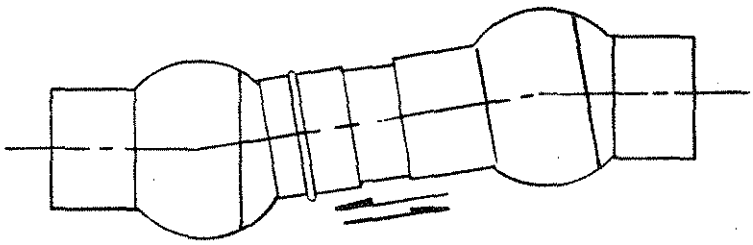
SINGLE SWIVEL
Will absorb radial-hinge movement maximum 10° any direction from axis



SINGLE SWIVEL WITH SLIP TUBE
Will absorb radial-hinge movement maximum 10° any direction from axis plus lateral movement along axis.



REF: 44SN or 55SN



DUAL SWIVEL WITH SLIP TUBE
Will absorb parallel misalignment (offset) as well as radial-hinge movement and lateral movement along axis.

A. Installed slip tube spacing is 1/2" minimum to 1-1/2" maximum. Use 1/2" minimum as standard

B. Plain end slip tube for welding. Allow 1" to 2" (1" is standard) space. Avoid weld splatter in this area.

C. Belled-slotted end for clamping

Slip tubes are individually fit and cannot be interchanged. Seal is permanent. Do not replace.

NOTE: Install in neutral or straight position as shown in top view to allow for maximum movement in service. (Installations of ±2° from neutral axis will be acceptable).

COMPILED	ERK	SHOP PRACTICE EXHAUST CLAMP INSTALLATION	SECTION NUMBER 33-04107
APPRV	A Q		
ISSUE DATE	01/27/75		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	H		PA2042-72

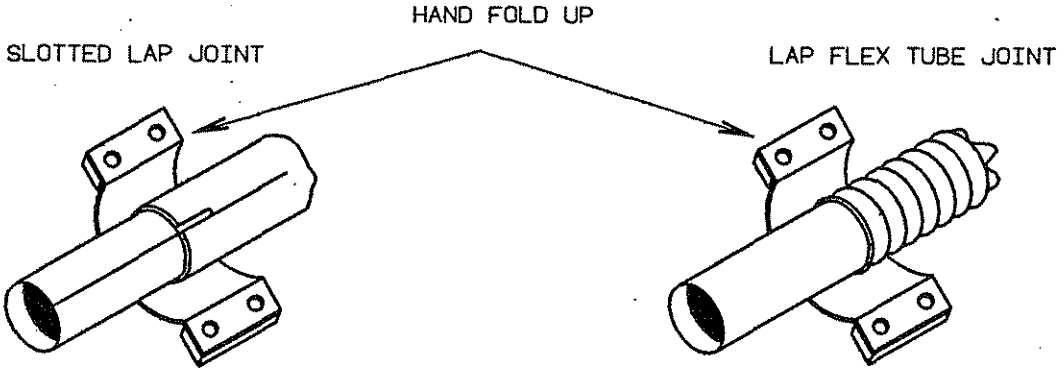
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0004-004 FOR EXHAUST CLAMP INSTALLATION.

COMPILED	ERK	SHOP PRACTICE CLAMP INSTALLATION	SECTION NUMBER 33-04107
APPRV	AQ		
ISSUE DATE	01/27/75		PAGE 1 OF 2
REV DATE	04/15/91	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	F		PA2024-76

A. SEAL-CLAMP, DONALDSON:

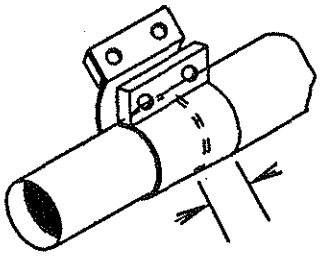
INSTALLATION PROCEDURE IS AS FOLLOWS:

1. FORM CLAMP TO LAP JOINT.*

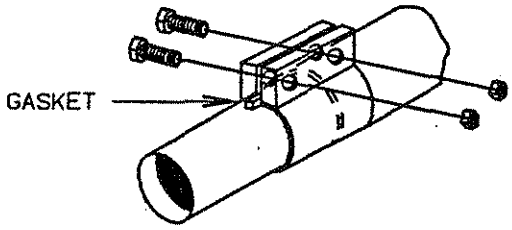


* SEAL-CLAMPS ARE NOT TO BE REUSED ONCE INSTALLED.

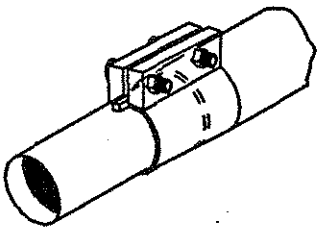
2. POSITION 1/3 TO 1/2 WAY ON TO LARGER DIAMETER TUBE.



3. ASSEMBLE BOLTS AND POSITION GASKET BETWEEN CLAMP BOLTS AND TUBE.



INSTALLATION COMPLETE



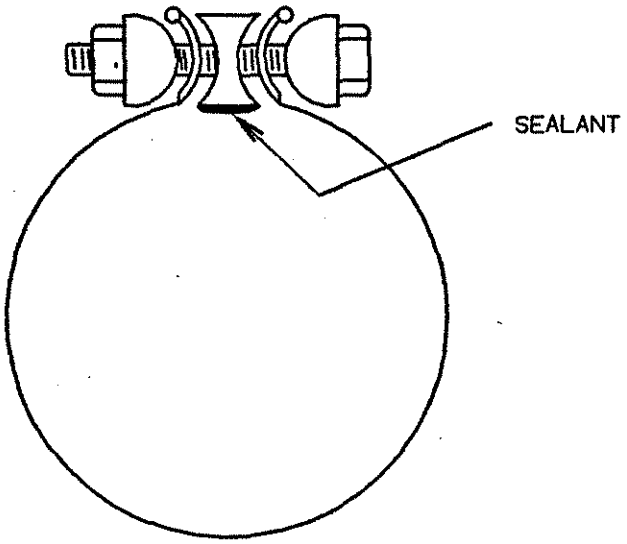
4. TORQUE ALTERNATELY UP ON EACH NUT STARTING ON LARGER TUBE DIAMETER END; TORQUE TO 50-75 FT-LBS. CLAMP WILL CONFORM TO THE DISSIMILAR DIAMETERS OF THE FLEX PIPE OR SLOTTED TUBE LAP JOINTS.

CAUTION: HOLD BOLT HEADS STATIONARY AND PARTIALLY TIGHTEN EACH NUT ALTERNATELY UNTIL TORQUE IS ACHIEVED OR BOLT FAILURE CAN OCCUR.

B. TORCA CLAMPS:

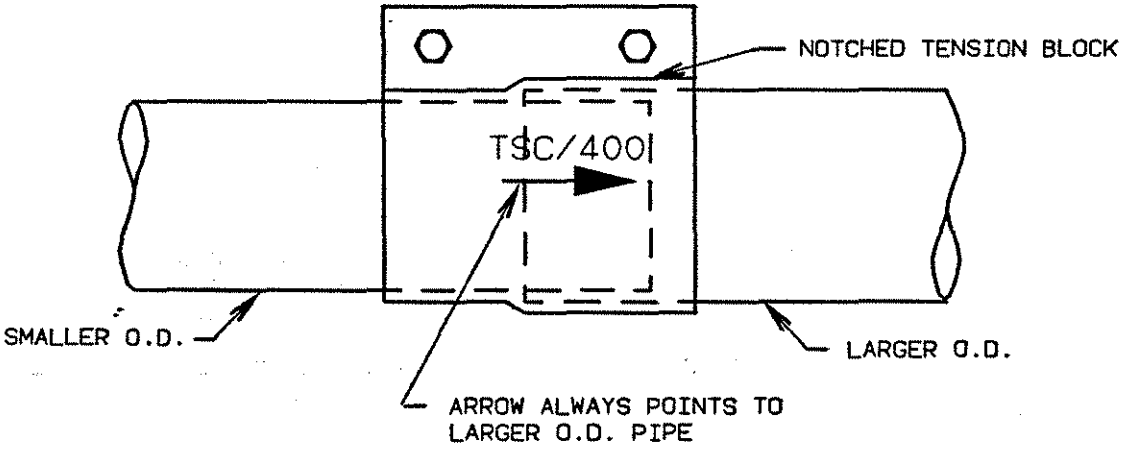
TORCA CLAMPS ARE RECEIVED ASSEMBLED. TO INSTALL, SLIDE THE SMALL DIAMETER END OF THE CLAMP OVER THE SMALLER EXHAUST TUBE. PUSH THE SMALL TUBE INTO THE LARGE TUBE AND SLIDE THE CLAMP TO COVER THE JOINT. TORQUE THE BOLTS TO 50-70 FT. LBS. F

IF THE CLAMP IS DISASSEMBLED FOR ANY REASON, THE SPACER BLOCK MUST BE REASSEMBLED WITH SEALANT WHERE IT IS IN CONTACT WITH THE TUBING.



C. RIKER, TRU-SEAL:

HAS THE SAME INSTALLATION PROCEDURE AS THE DONALDSON SEAL-CLAMP, SEE PAGE 1, EXCEPT THE RIKER CLAMP HAS NOTCHED TENSION BLOCKS THAT MUST BE INSTALLED OVER THE LARGER DIAMETER PIPE OR FLEX HOSE. THIS ALLOWS FOR THE DIFFERENCES IN THE O.D. OF PIPE CONNECTIONS.

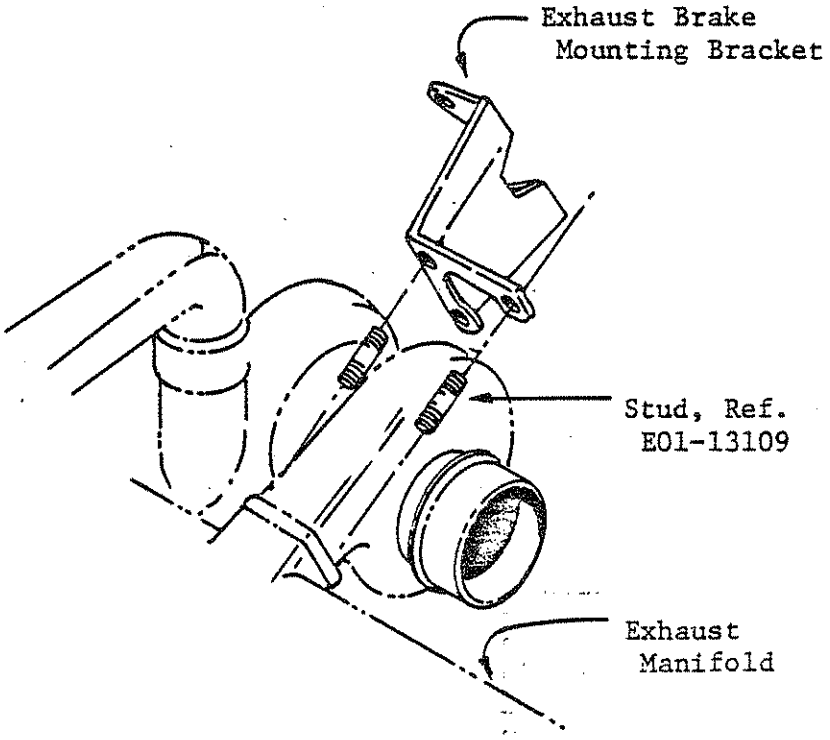


Compiled	R. GEBO	SHOP PRACTICE EXHAUST BRAKE BRACKET MOUNTING	33-04108
Approved	SEEMAN		
Issued	2-22-77		
Revised		Chg Ltr	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

CUMMINS NTC SERIES INSTALLATION

The support bracket to the exhaust brake from the turbo mounting flange will use three studs, for securing. Note that if the studs existing in the turbo mounting flange are too short, and will not permit adequate thread engagement into the nut they are to be replaced with longer studs, E01-13109.



Compiled	F. FREER	SHOP PRACTICE EXHAUST STACK HEIGHT MEASUREMENT	33-04110
Approved	JAKE		
Issued	1-10-79		
Revised	9-18-81	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	

Exhaust Height Measurement

B The stack height is normally measured at the end of the top stack (pipe) proper. If, however, a weather cap is installed, the measurement is to the top of the weather cap in fully open position.

A The height, as specified on the Chassis specification sheet, has a tolerance of ± 1.00"

Note: Height must not exceed 13'6".

Compiled	F.FREER	SHOP PRACTICE RADIATOR, CONTENTS	33-05100
Approved			
Issued	04/07/65		
Revised	07/21/88	Chg Ltr M FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-38

PRACTICE NO.	DESCRIPTION
33-05104	RADIATOR HOSE INSTALLATION
33-05107	ANTIFREEZE INSTALLATION
33-05108	RADIATOR FAN INSTALLATION
33-05109	FASTENER TORQUE

REFERENCES:

Huckbolts 33-00109

COMPILED	HJR	SHOP PRACTICE RADIATOR HOSE INSTALLATION CONSTANT TORQUE HOSE CLAMP	SECTION NUMBER 33-05104
APPRV	VHS		
ISSUE DATE	03/11/87		
REV DATE	07/29/96		PAGE 1 OF 1
CHG LTR	D	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0005-001 FOR RADIATOR HOSE INSTALLATION.

COMPILED	HJR	SHOP PRACTICE RADIATOR HOSE INSTALLATION CONSTANT TORQUE HOSE CLAMP	SECTION NUMBER 33-05104
APPRV	VHS		
ISSUE DATE	03/11/87		PAGE 1 OF 1
REV DATE	07/25/95	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		P6349H-01

1. GREASE & SEALANTS - PLAIN WATER WILL PERMIT EASIER ASSEMBLY OF A HOSE TO ITS FITTINGS AND TEND TO PREVENT SCUFFING THE INNER SURFACE AT THE JUNCTION.

   HOWEVER, USE NO GREASE OR SEALANTS ON THE HOSES WHEN INSTALLING THEM ON THIER FITTINGS.

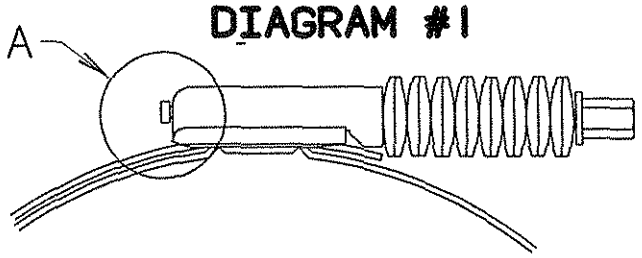
2. HOSE INSTALLATION - THE FOLLOWING CRITERIA IS TO BE FOLLOWED:

   A. MINIMUM FITTING OVERLAP SHOULD BE 1.5".

   B. FITTING ALIGNMENT MUST BE CAREFULLY CHECKED TO AVOID BENDING OR KINKING THE HOSE.

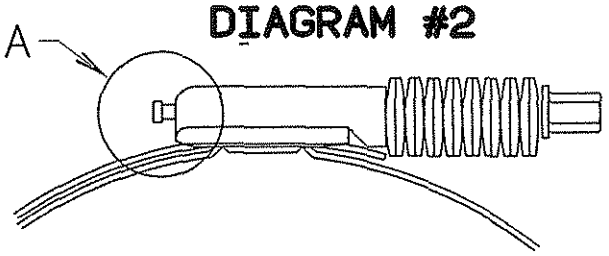
   CONSTANT TORQUE CLAMPS ARE TO BE INSTALED PER DIAGRAM #3 (125 ±5 IN/LBS).

DIAGRAM #1



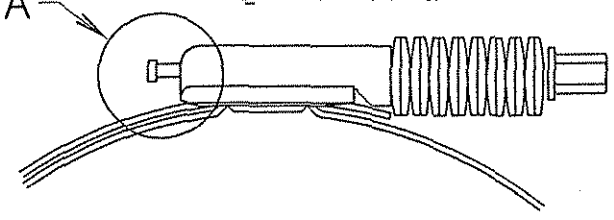
CLAMP INSTALLED AT 50 IN/LBS. NOTE: SCREW TIP 'A' PROTRUDING SLIGHTLY FROM HOUSING.

DIAGRAM #2



CLAMP INSTALLED AT 90 IN/LBS. NOTE: SCREW TIP 'A' PROTRUDING AND COMPRESSION OF BELLEVILLES.

DIAGRAM #3



CLAMP INSTALLED AT 125 IN/LBS. NOTE: SCREW TIP 'A' EXTENDED WELL BEYOND THE HOUSING. BELLEVILLES ARE COMPRESSED TO ABOUT 90% OF FLAT.

TORQUE LOSS FROM RUBBER HOSE COMPRESSION ("COLD FLOW") AFTER INITIAL INSTALLATION WILL LEAVE CLAMP TORQUE AT 90-100 IN/LBS.

COMPILED	HEILESON	SHOP PRACTICE INSTALLATION ANTI-FREEZE	SECTION NUMBER 33-05107
APPRV	ROLLINS		
ISSUE DATE	04/08/74		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	K		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0005-002 FOR ANTI-FREEZE INSTALLATION.

COMPILED	HEILESON	SHOP PRACTICE INSTALLATION ANTI-FREEZE	SECTION NUMBER 33-05107
APPRV	ROLLINS		PAGE 1 OF 1
ISSUE DATE	04/08/74	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-34
REV DATE	03/17/93		
CHG LTR	J		

A. GENERAL:

ANTIFREEZE TO BE INSTALLED IN FREIGHTLINER VEHICLES MUST BE AS SPECIFIED OR APPROVED FOR USE BY ENGINEERING.

VEHICLES RECEIVE A 50% ANTIFREEZE SOLUTION AS STANDARD FOR PROTECTION TO -35°F ±5°F. THE CONCENTRATION LEVEL IS NOT TO EXCEED THE -40°F LEVEL UNLESS SPECIFICALLY DESIGNATED BY ENGINEERING.

B. COOLING SYSTEM PREPARATION:

BEFORE INSTALLING ANTIFREEZE COMPOUND IN A COOLING SYSTEM:

1. CHECK FOR WATER TIGHTNESS AT ALL GASKETED JOINTS, MAKING SURE THAT GASKETS AND SEALING SURFACES ARE UNDAMAGED AND THAT NO SCALE OR OTHER FOREIGN PARTICLES ARE TRAPPED THERE BEFORE TIGHTENING THE JOINT.

2. CHECK FOR WATER TIGHTNESS OF ALL CLAMPED HOSE CONNECTIONS AND AT THE SAME TIME MAKE SURE HOSES ARE INSTALLED WITHOUT STRAIN, KINKS, OR SHARP BENDS, AND ARE OTHERWISE FREE OF DAMAGE.

3. CHECK FOR CLEANLINESS, FREEDOM FROM SLUDGE AND DIRT.

C. INSTALLING ANTIFREEZE:

AFTER PREPARATION OF THE COOLING SYSTEM:

1. FILL COOLING SYSTEM UP TO, BUT NOT BEYOND, FILL LEVEL.
(DO NOT OVERFILL - ANY EXCESS WILL SIMPLY BE WASTED WHEN THE SYSTEM COMES UP TO RUNNING TEMPERATURE)

2. INSTALL RADIATOR CAP AND MAKE FINAL INSPECTION FOR ANY LEAKS IN THE SYSTEM.

JGON ID=

COMPILED	B L	SHOP PRACTICE FAN INSTALLATION	SECTION NUMBER 33-05108
APPRV	SJH		
ISSUE DATE	06/23/80		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	F		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0005-003 FOR FAN INSTALLATION.

Compiled	B. LEVINGS	SHOP PRACTICE FAN INSTALLATION	33-05108
Approved	SJH		
Issued	6-23-80		
Revised	6-11-86	Chg Ltr E FREIGHTLINER CORPORATION PORTLAND, OREGON	

FAN TO SHROUD PLACEMENT

When properly installed, the fan should intrude into the shroud as shown below.

Engine Angle	Placement
3°	2/3 of fan width inside shroud ± .50
5°	0" of fan width inside shroud at top, 1/2 width in at bottom ± .50

REVISED TO REDRAWN 'E' CHANGE

Compiled	F. FREER	SHOP PRACTICE FASTENERS BOLT TORQUE	33-05109
Approved			
Issued	12-16-77		
Revised	1-30-84	Chg Ltr D **FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 1

D SPECIAL VALUES: For the fasteners listed use the indicated torque values.

FASTENER	THREAD SIZE	GRADE	TORQUE FT-LB	
Fan studs	5/16" 3/8"	5 5	11-15 20-25	

D GENERAL VALUES: See 33-00109.

COMPILED	E R K	SHOP PRACTICE	SECTION NUMBER
APPRV	C W	FAN SHROUD ADJUSTMENT	33-05110
ISSUE DATE	02/05/92		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	A		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0005-004 FOR FAN SHROUD ADJUSTMENT PROCEDURE.

COMPILED	F.FREER
APPRV	DJL
ISSUE DATE	04/07/65
REV DATE	04/09/93
CHG LTR	AF

SHOP PRACTICE

CONTENTS
ELECTRICAL

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-06100
PAGE 1 OF 1
PA2101-01

33-06101	PROTECTION & ROUTING OF WIRING, GENERAL
33-06102	GROUND & GROUNDING, GENERAL
33-06103	TERMINAL CONNECTION, GENERAL
33-06104	BATTERY, TERMINAL PROTECTION
33-06105	BATTERY CABLE CONNECTION
33-06107	BATTERIES, DRY CHARGE
33-06108	ALTERNATOR, GENERAL INSTRUCTIONS
33-06109	ELECTRICAL CIRCUIT NUMBERS
33-06110	BATTERIES, CHARGING
33-06111	CAB WIRING, HARNESS ROUTING
33-06112	SPARE CONDUCTORS IN WIRING HARNESSES
33-06113	AMMETER WIRING
33-06114	ENGINE HARNESS INSTALLATION
33-06116	TRACTOR/TRAILOR ELECTRICAL TEST
33-06117	VEHICLE CONTROL LABELING
33-06118	SOLDERING ELECTRICAL TERMINALS
33-06120	SPOTLIGHT INSTALLATION
33-06125	WIRING SIZING GUIDELINES
33-06126	ELECTRICAL TERMINAL PROTECTION
33-06127	FRAME GROUND WELD STUD INSTALLATION

COMPILED	DJL	SHOP PRACTICE	SECTION NUMBER 33-06101
APPRV	DJL		
ISSUE DATE	09/16/85	PROTECTION AND ROUTING OF WIRES	PAGE 1 OF 1
REV DATE	07/29/96		
CHG LTR	B	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-001/02/03 FOR WIRE ROUTING PROTECTION.

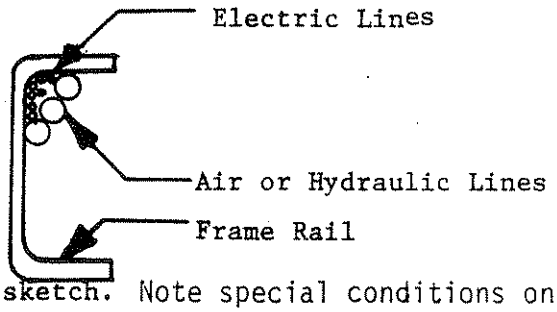
A. GENERAL

The care the wiring receives during its installation is probably the last it will get until some part of it fails. It is extremely important then to install the wiring in such manner as to insure trouble-free operation for the life of the vehicle. Aside from the quality of the basic wire insulation, two areas of importance can be stressed. They are routing and protection.

B. ROUTING OF WIRING

Routing of the basic wiring is periodically reviewed by Corporate Engineering, Inspection and Shop personnel, but changes in other components of the vehicle may create changes in routing of the wiring, so all persons involved with the electrical system should be on the alert for potential problems, and should report them to their foreman. In the frequent cases of wiring optional electrical equipment, individual judgment will be called for and the best possible practices should be used.

Whenever possible electric wires should be routed behind air and hydraulic lines which utilize wire braid protective coverings. This should be done to protect electric wiring that does not have the benfit of a protective covering. The most desirable place to route electric wire and air or hydraulic lines on the frame rail, is under the upper flange as shown in the sketch. Note special conditions on page 5.



C. PROTECTION OF WIRING

Protection of the wiring must be provided wherever there is a possibility of damage that cannot be avoided by minor changes in routing. Abrasion due to vibration and movement of the wiring encountered in normal vehicle operation is the major cause of damage to the wiring. Abrasion is usually caused by sharp metal edges in contact with the wire, but can also result from use of unprotected clamps, to sheet metal screws and bolts that the wiring may rest upon, and to many other likely and unlikely causes. Particular attention should be given to "blind" areas, such as wiring running through a door post, header beam, or nose beam, to make sure that all possible hazards are eliminated or protected against. However, exposed wiring is often subject to other types of damage and it has been our practice to protect all wiring outside the cab enclosure, as well as in specific areas within the cab. When it is absolutely necessary for wiring to be routed near a sheet metal edge the edge should be covered with vinyl trim (Ref. 18-11197-0).

D. PROTECTIVE COVERINGS & FASTENERS

In all cases protective coverings shall be of a material of endurance equal to or greater than the materials they are protecting.

(Continued)

D. PROTECTIVE COVERINGS & FASTENERS

In securing wiring and harnesses, non-metallic clips such as tiewraps, snap-ins, etc, shall be used. Metallic fasteners must not be used.

The following materials are used as noted:

1. Loom: The common asphalt-impregnated, cotton braid, automotive electrical loom is used in a variety of sizes as specified on harness drawings and for general use where protection is required. (This material is replaced by convoluted tubing within the cab.)

2. Electrical Tape: Vinyl plastic tape is supplied to the shops in 7 mil (.007 inch) and 10 mil (.0010 inch) thickness. The 10 mil tape is used for harness wrapping where a continuous coverage is required; closure of loom ends, etc. (Ref. 48-00126)

3. Hose: Rubber sheathing is used to cover the speedometer and tachometer drive cables in the area where it could come in contact with wiring or electrical terminals. This protective covering is specified as part of the cable assembly. For Vancouver, B.C., construction, and for other areas where gravel roads are common, protect exposed battery cables with heater hose.

4. Grommets: Rubber grommets or other edge-protecting material specifically approved by Corporate Engineering must be used wherever wiring passes through a hole in a metal sheet. The protection afforded by a grommet is very good; in fact, wiring is sometimes purposely routed through a sheet metal section rather than around it to take advantage of this.

5. Clamps: Wiring should be supported and restrained by clamping to the solid structure of the vehicle at intervals short enough to prevent unnecessary motion and maintain the desired routing, but not so short that strain may be placed upon the wiring due to any conceivable mode of normal operation. If vehicle has Freightliner air suspension, see 33-16108.

   In exposed locations, take special care to clamp loose loops to avoid failure from build-up of ice. An example of this is the extra loop of road light harness in the vicinity of the headlights.

   Clamps for single insulated wiring shall be an insulated type such as molded lining, cushioned wall or dip coated.

   Clamps for double insulated wiring can be either an insulated type per above or an approved wiring spring clip.

D. PROTECTIVE COVERINGS & FASTENERS CONTINUED

Spring clips are approved for the following types of double insulated wiring:

1) Insulated wiring inside convoluted tubing.
2) Insulated wiring with a separate jacket such as multi-conductor jacketed cable.
3) Insulated wiring inside loom.

Approved spring clips are 23-09396-000 and -001.

Tighten clamps enough to resist relative motion with the wire, but not so much as to cause damage to the insulation of the wiring.

At the right front cab pivot, special flexible metallic loom is sometimes specified to protect the air hoses. In such cases, the electric wiring there must be bundled and clamped separately to prevent chaffing through the insulation and short circuiting the wires.

6. Cable Ties: Wiring, hoses, etc., running as a group, must be bound together at about 8-12 inch intervals. If anchor clamps (or wiring terminals) are at greater distances apart, a plastic tie strap must be used to keep the smaller diameter items from becoming separated and liable to damage.

   Preferably, use approved tooling to install straps. If hand installed, care must be taken to make the straps snug enough to prevent chaffing, but not so tight as to damage insulation or pinch hoses.

   For bundles of lines in exposed locations, such as under the cab outside the frame, a heavy-duty cable tie is to be used. Acceptable for this service are: 23-9796, 300, 400 or 500 dash number series.

   For lines in a protected position, such as under the dash in the cab, or within the frame rails, a lighter duty tie may be used. Acceptable for this service are: 23-9796, 100 or 200 dash number series.

   CAUTION: Do not use flat, strip-type aluminum ties for holding electric conductors without specific callout from Corporate Engineering.

7. Convoluted Tubing: There are two types of convoluted tubing that are used to protect wiring within the cab and chassis. One may be used within the cab or in the chassis; the other must be used only in the chassis.

D. PROTECTIVE COVERINGS & FASTENERS CONTINUED

a. Cab interior or chassis: Any material used within the interior of the cab must comply with FMVSS #302, flamability of interior materials. The material specification for 48-2218-0 is for a Gray colored flame retardent polyethylene tubing. This material complys with FMVSS #302 and therefore, may be used within the cab or in the chassis.

b. Chassis: The material specification for 48-2217 # is for Black nylon tubing. This material does not comply with FMVSS #302 and therefore, can only be used in the chassis.

c. Battery cables: See 33-06105.

8. Junction Boxes: Junction boxes such as tail lamp junction boxes and Conventional hood harness junction boxes that are supplied with grease fittings shall be filled with a non-corrosive grease (48-2439). On junction boxes without grease fittings, apply liberal amounts of non-corrosive grease (48-2439) directly to terminals.

9. Chassis Harness: Breakouts (individual wires) of up to 8.00 inches are acceptable as long as these wires are routed safely away from sharp points and edges, moveable parts, and other possible sources of abrasion, cutting, pinching, or crushing.

10. Exterior Splice Installation: All exterior splices must be environmentally sealed. Use one of the following methods.

Method I

Use a 23-11196-# butt splice and seal connection using 48-02461-# shrink tube.

a. Wire Preparation: Strip each wire.

b. Shrink tube preparation: Select the smallest size of shrink tubing that will fit snugly over splice. Cut shrink tubing a minimum of 3/4" per end longer than splice. Slip the shrink tube onto the wire(s) prior to crimping.

c. Crimp installation: Insert the wire(s) into one end of the splice. Note: A built-in wire stop in the crimp barrel will help locate the wire. Center the jaws of the crimp tool between the wire stop (located in the center of the crimp barrel) and the end of the metal crimp barrel. Actuate the crimp tool. Repeat for th wire(s) to be joined to other side of splice.

A
Y

d. Inspection for proper crimping: Impressions from the jaws of the crimp tool must be visible on both sides of the splice. The impressions should be centered approximately between the center of the crimp barrel and the ends of the crimp barrel.

e. Shrink tube installation: Center the shrink tube over the splice and apply heat (250 F) until completely shrunk against wire. Sealant material must be visible along wire unsulation. Note: For proper sealing around multiple wires, it may be necessary to use a needle-nose plier to pinch shrink tube down between wires.

Method II

(See next page (Page 6)

A

Method II

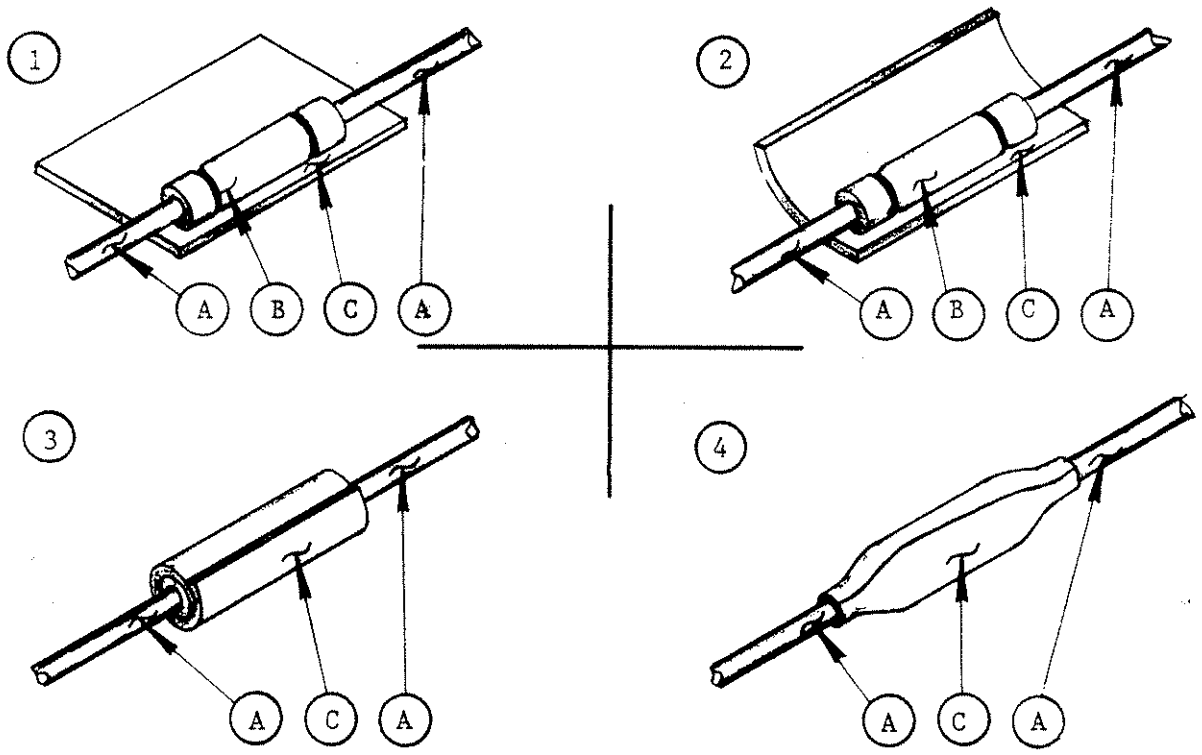
Use a 23-11196-# butt splice and seal connection using 48-02116-000 mastic tape. Recommended method for using mastic type of seal for exposed splices:

1 Cut tape a minimum of 1/4 inch per end, longer than splice connector.

2 & 3 Roll tape tightly around splice connector.

4 Pinch ends of tape around wire to seal.

Note: Method II to be used only if Method I cannot. Example: Use Method II when the shrink tube reduction is not adequate to seal around a small gauge vendor pigtail which is the case with the engine mounted air fan switch.



A WIRE

B SPLICE CONNECTOR

C TAPE (REF. 48-02116-000)

COMPILED	D J L	SHOP PRACTICE GROUNDS AND GROUNDING	SECTION NUMBER 33-06102
APPRV	D J L		
ISSUE DATE	04/07/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	J		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-004 FOR GROUNDS AND GROUNDING PROCEDURES.

COMPILED	DJL
APPRV	DJL
ISSUE DATE	04/07/65
REV DATE	09/23/94
CHG LTR	H

SHOP PRACTICE

GROUNDS AND GROUNDING

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-06102

P6339H-01

THE IMPORTANCE OF PROVIDING GOOD GROUND PATHS CANNOT BE OVER-EMPHASIZED, SINCE THESE CONDUCTORS MAKE UP ABOUT HALF OF MOST ELECTRICAL CIRCUITS OF THE TRUCK. THE FRAME RAILS, ENGINE BLOCK, ELECTRICAL COMPONENT MOUNTING BRACKETS, EVEN THE CAB ITSELF, ARE VITAL PARTS OF THE TOTAL ELECTRICAL SYSTEM. TO MAKE SURE THAT A GOOD CONTINUOUS ELECTRICAL PATH IS MAINTAINED, GROUND JUMPERS ARE PROVIDED WHEREVER THE CONTINUITY OF THE CIRCUIT IS IN QUESTION, SUCH AS FROM THE FRAME CROSSMEMBER TO THE LICENSE PLATE LIGHT, FROM THE FRAME TO THE CAB, ETC.

SOME OF THE METHODS OF ASSURING GOOD CIRCUITS ARE AS FOLLOWS:

1. WHERE GROUND STRAPS ARE ATTACHED TO THE FRAME OR OTHER STRUCTURAL PARTS OF THE VEHICLE, MAKE SURE THAT THE SURFACES ARE CLEAN AND FREE OF PAINT, RUST AND OTHER FOREIGN MATTER.

2. ATTACH GROUND STRAPS SECURELY IMMEDIATELY AFTER CLEANING SURFACES TO PREVENT RECONTAMINATION OF THE CONTACT SURFACES.

3. WHEN A BOLTED-ON BRACKET PROVIDES THE GROUND PATH, CLEAN AN AREA AROUND A FEW OF THE BOLT HOLES ON BOTH SURFACES TO ASSURE GOOD CONTACT.

H 4. FOR UNITS WITH ELECTRIC STARTERS, RUN THE ALTERNATOR GROUND TO THE STARTER GROUND TERMINAL. FOR UNITS WITH AIR STARTERS, RUN THE ALTERNATOR GROUND TO THE BATTERY GROUND POINT ON THE FRAME RAIL.

5. ALL ENGINES WILL HAVE GROUNDING STRAPS RUN TO THE FRAME RAIL REGARDLESS OF WHETHER AN ELECTRIC OR AIR STARTER IS USED.

6. ALL NON-SEALED CONNECTIONS OUTSIDE OF THE CAB ARE TO BE COATED WITH RED ENAMEL DIELECTRIC SPRAY SEALER PER 33-06126.

7. NO MORE THAN 5 INDIVIDUAL GROUND WIRES ARE TO BE STACKED AND SECURED BY A SINGLE FASTENER.

CAUTION: DO NOT ROUTE AND/OR CLAMP FUEL LINES AND BATTERY CABLES TOGETHER.

COMPILED	DJL	SHOP PRACTICE TERMINAL CONNECTIONS	SECTION NUMBER 33-06103
APPRV	ACL		
ISSUE DATE	11/11/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-005 FOR TERMINAL CONECTIONS.

A. TERMINAL CONNECTIONS

As a general rule, all terminal connections are to be made using a plastic insert friction type locknut; Kep nuts (nuts with integral toothed washers) are not an acceptable alternate. The purpose is to prevent loosening of the wiring. All washers, terminals, nuts, and in certain cases, screws or bolts, are to be corrosion resistant, either by virtue of being made of a noncorrosive material (brass, bronze, copper, etc.) or due to corrosion resistant coating (cadmium, nickel, chrome).

B. EXCEPTIONS

All general rules have certain exceptions, and a few of them should be noted as examples:

1. The ground end of the cab ground wire should be in direct contact with a cleaned area of the frame rail. Place the lockwashers on top of the terminal and on the opposite side of the frame rail.

2. Use the washers and nuts provided on the battery cable connections to the starter motor.

3. On purchased electrical components in general, use the lockwasher and locknut as stated in the general rule if the threaded stud is long enough to engage the locking ring of the nut, and use the fasteners provided if the stud is too short or if the component has screw terminals.

C. MAINTENANCE PRECAUTION

In any event, do what can be done to provide secure, maintenance-free electrical connections. This includes avoiding shims and washers as much as possible and especially, do not use lead shims on battery posts.

D. SOLDERED CONNECTIONS

The following terminal connections are to be dip soldered.

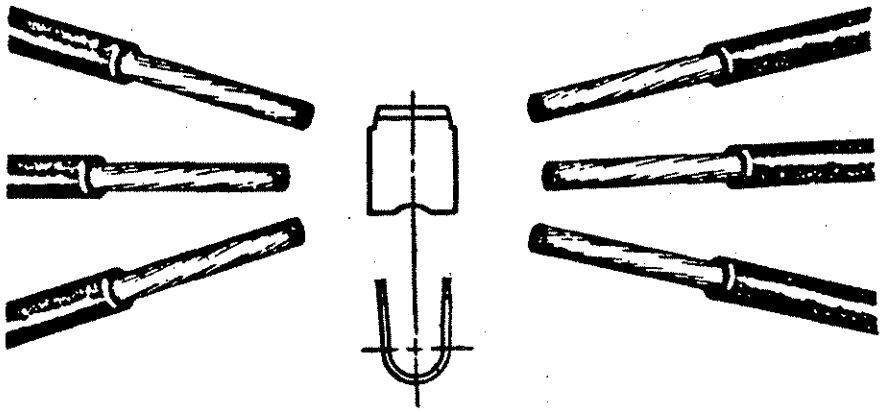
1. Alternator field used with externally mounted regular.

2. Alternator output

3. Alternator ground

4. Splice cups - See Page 2.

E. SPLICE CLIP 23-11283



ASSEMBLY PROCEDURE:

1. Grab wires and tap on side of Die to even up ends.
2. Place ends overlapping in open "U" of Splice Clip and step on switch (Cycle Time = 1.5 Sec.)
3. Remove crimped wire splice.
4. Dip solder as per 33-06118.
5. Wrap splice with tape
   A. 48-02116 or
   B. 48-00126 3/4" 3 wraps

F. TERMINAL INSULATORS

The 06-11881-0 insulator is designed to be used with all uninsulated ring terminals (except for ground circuits) where, by nature of its design, it will physically work. In those cases where the 06-11881-0 insulator will not work, those terminals must be insulated with a material acceptable to Corporate Engineering. (Ref. 48-2211-038 shrink tubing)

G. TIE STRAPPING OF EIGHT PIN CONNECTORS

Part Number Ref: (PAC) 2965977 Plug
(PAC) 2965972 Housing

The above NON-LOCKING connector combination must be secured using 23-9796 # cable tie.

H. SPLICE CONNECTION (MULTIPLE WIRE)

All exterior splices must be environmentally sealed (See Section 33-06101). Cab interior splices can be either the 23-11196-000 listed below or the machine applied 23-11283-000 splice clip.

1. 23-11196-010 splice can be used for multiple wire splicing as long as the combined total circular mil areas (CMA) fall within the required 5180-13100 range.

   14 GA = 3838 CMA
   16 GA = 2426 CMA
   18 GA = 1900 CMA

   It may be necessary to double back the wire core or insert all wires into one end of splice to satisfy the above CMA requirement.

   NOTE: The wire insulation will allow a maximum of two 14 GA, three 16 GA, or five 18 GA wires per each end of splice.

J. RING TERMINAL ATTACHMENT TO STUDS

Ring terminals must be attached to studs using nylon shoulder nuts. KEP nuts (nuts with integral star washers) are no longer approved for this application. Use 23-09336-XXX for coarse thread series and 23-09337-XXX for fine thread series of nylon shoulder nuts.

COMPILED	DJL
APPRV	ACL
ISSUE DATE	11/11/85
REV DATE	03/08/91
CHG LTR	D

SHOP PRACTICE
TERMINAL CONNECTIONS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-06103

PA2024-70

A. TERMINAL CONNECTIONS

AS A GENERAL RULE, ALL RING TERMINAL CONNECTIONS ON THREADED STUDS ARE TO BE MADE USING A PLASTIC INSERT FRICTION TYPE LOCKNUT; KEP NUTS (NUTS WITH INTEGRAL TOOTHED WASHERS) ARE NOT AN ACCEPTABLE ALTERNATE. THE PURPOSE IS TO PREVENT LOOSENING OF THE WIRING. ALL WASHERS, TERMINALS, NUTS, AND IN CERTAIN CASES, SCREWS OR BOLTS, ARE TO BE CORROSION RESISTANT, EITHER BY VIRTUE OF BEING MADE OF A NONCORROSIVE MATERIAL (BRASS, BRONZE, COPPER, ETC.) OR DUE TO CORROSION RESISTANT COATING (CADMIUM, NICKEL, CHROME).

B. EXCEPTIONS

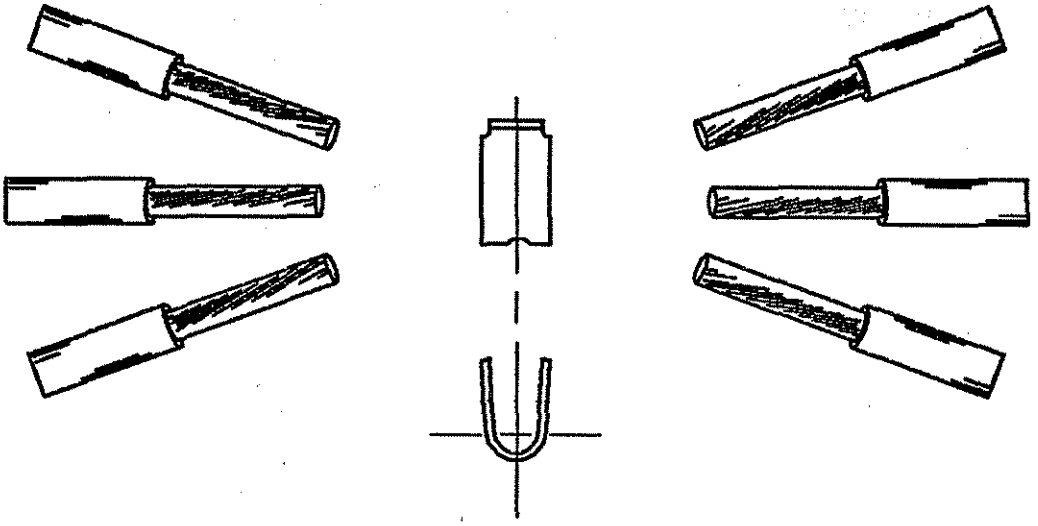
ALL GENERAL RULES HAVE CERTAIN EXCEPTIONS, AND A FEW OF THEM SHOULD BE NOTED AS EXAMPLES:

1. THE GROUND END OF THE CAB GROUND WIRE SHOULD BE IN DIRECT CONTACT WITH A CLEANED AREA OF THE FRAME RAIL. PLACE THE TOOTHED LOCKWASHERS ON TOP OF THE TERMINAL AND ON THE OPPOSITE SIDE OF THE FRAME RAIL.
2. USE THE WASHERS AND NUTS PROVIDED FOR THE BATTERY CABLE CONNECTIONS TO THE STARTER MOTOR.
3. FOR PURCHASED ELECTRICAL COMPONENTS IN GENERAL, USE THE LOCKNUT AS STATED IN THE GENERAL RULE, PARAGRAPH A, IF THE THREADED STUD IS LONG ENOUGH TO ENGAGE THE LOCKING RING OF THE NUT, AND USE THE FASTENERS PROVIDED IF THE STUD IS TOO SHORT OR IF THE COMPONENT HAS SCREW TERMINALS.

C. MAINTENANCE PRECAUTION

IN ANY EVENT, DO WHAT CAN BE DONE TO PROVIDE SECURE, MAINTENANCE-FREE ELECTRICAL CONNECTIONS. THIS INCLUDES AVOIDING SHIMS AND WASHERS AS MUCH AS POSSIBLE AND ESPECIALLY, DO NOT USE LEAD SHIMS ON BATTERY POSTS.

D. SPLICE CLIP 23-11283



ASSEMBLY PROCEDURE:

1. GRAB WIRES AND TAP ON SIDE OF DIE TO EVEN UP ENDS.
2. PLACE ENDS OVERLAPPING IN OPEN "U" OF SPLICE CLIP AND STEP ON SWITCH.
3. REMOVE CRIMPED WIRE SPLICE.
4. DIP SOLDER PER 33-06118.
5. SEAL WITH HEAT SHRINK TUBING
   48-02461-#: SPLICE LOCATED INTERIOR OF CAB.
   48-25005-#: SPLICE LOCATED EXTERIOR OF CAB.
6. THE USE OF A SPLICE IS NOT ACCEPTABLE OUTSIDE OF THE CAB IF THERE IS MORE THAN ONE (1) WIRE PER SIDE.

COMPILED	H J R	SHOP PRACTICE	SECTION NUMBER
APPRV	E TRANS	BATTERY TERMINAL PROTECTION	33-06104
ISSUE DATE	04/27/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	B		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-006 FOR BATTERY TERMINAL PROTECTION.

Compiled	H.J.R.	SHOP PRACTICE	33-06104
Approved	E. Travis	BATTERIES, PROTECTION OF TERMINALS	
Issued	4-27-65	Chng Ltr: A FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-30
Revised	11-9-84		

Protecting battery terminals against physical damage and against corrosion is necessary if a good, low-resistance connection is to be made by the cable lug. Physical damage is often the result of effort to remove a battery cable whose lug is stuck to the battery post by corrosion. When corrosion, dirt or some other condition reduces the contact area of a connection, the resistance of that connection increases. If the reduction is at all severe, the starter motor may not get enough current to start the engine. Since low temperatures reduce battery efficiency and increase the difficulty of starting the engine, the quality of battery and other connections is especially critical in winter time and extremely so in colder climates.

"JAX" E-Z BATTERY SAVER & CLEANER* is a pressurized spray ... ed preparation for cleaning and protecting battery connections. ... factory results, manufacturer's recommendations for use must be st... d.

A
A

FOR BATTERY CABL... ...ered Post)

1. Shake can well. Spray batter... ...d allow to stand 3 minutes.
2. Wipe off battery save... ... thoroughly clean.
3. Install terminal ... ...rely.
4. Spray assem... ...ions again lightly and let remain.
5. Replace p... ...can in a safe place. When empty, provide for safe disposal o... DO NOT put in regular trash containers because of danger of explosion in incinerator.

REMOVE & DESTROY

FOR BATTERIES GOING INTO STORAGE

1. Shake can well. Spray terminals lightly and allow to stand for 3 minutes.
2. Wipe off battery saver and loose dirt until clean.
3. Spray terminals again and allow to remain without wiping.

* Manufactured by Pressure-Lube, Inc., Butler, Wisc.

Compiled	H.J.R.	SHOP PRACTICE	33-06104
Approved	E. Travis	BATTERIES, PROTECTION OF TERMINALS	
Issued	4-27-65	FREIGHTLINER CORPORATION	
Revised	1/12/68	Chng Ltr: PORTLAND, OREGON	

Protecting battery terminals against physical damage and against corrosion is necessary if a good, low-resistance connection is to be made by the cable lug. Physical damage is often the result of effort to remove a battery cable whose lug is stuck to the battery post by corrosion. When corrosion, dirt or some other condition reduces the contact area of a connection, the resistance of that connection increases. If the reduction is at all severe, the starter motor may not get enough current to start the engine. Since low temperatures reduce battery efficiency and increase the difficulty of starting the engine, the quality of battery and other connections is especially critical in wintertime and extremely so in colder climates.

"JAX" E-Z BATTERY SAVER & CLEANER* is a pressurized spray-can packaged preparation for cleaning and protecting battery connections. For satisfactory results, manufacturer's recommendations for use must be strictly followed.

FOR BATTERY CABLE INSTALLATION

1. Shake can well. Spray terminals lightly and allow to stand 3 minutes.
2. Wipe off battery saver and loose dirt until thoroughly clean.
3. Install terminal lugs and tighten securely.
4. Spray assembled terminal connections again lightly and let remain.
5. Replace pressurized can in safe place. When empty, provide for safe disposal of can; DO NOT put in regular trash containers because of danger of explosion in incinerator.

FOR BATTERIES GOING INTO STORAGE

1. Shake can well. Spray terminals lightly and allow to stand for 3 minutes.
2. Wipe off battery saver and loose dirt until clean.
3. Spray terminals again and allow to remain without wiping.

* Manufactured by Pressure-Lube, Inc., Butler, Wisc.

COMPILED	T. YOUNG	SHOP PRACTICE BATTERY CABLE ROUTING AND INSTALLATION	SECTION NUMBER 33-06105
APPRV	DJL		
ISSUE DATE	07-19-85		PAGE 1 OF 2
REV DATE	05/05/93	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2101-02

INTRODUCTION:

THE TYPICAL STARTER/BATTERY SYSTEM USES POSITIVE BATTERY CABLE TO DIRECTLY CONNECT THE COMPONENTS. EACH COMPONENT GROUNDS TO THE LEFT SIDE RAIL WITH NEGATIVE CABLE, AND THE RAIL SERVES AS THE GROUNDING PATH.

AGAIN, ALL BATTERIES (INCLUDING LOCATIONS BETWEEN RAILS AND ON THE RIGHT-SIDE RAIL) MUST USE NEGATIVE CABLE TO GROUND TO THE LEFT-SIDE RAIL. SOME CUSTOM AND ALL ALUMINUM RAIL APPLICATIONS WILL USE NEGATIVE BATTERY CABLE FROM STARTER TO BATTERIES AS A DIRECT GROUND PATH.

IF BATTERY CUT-OFF SWITCHES ARE USED IN THE SYSTEM, THEY WILL ONLY BE USED WITH NEGATIVE CABLES. IF A SYSTEM IS SUPPLEMENTED WITH A JUMP-START ASSEMBLY, THE JUMPER MAY CONNECT DIRECTLY TO THE STARTER OR TO THE POSITIVE BATTERY INTERCONNECTOR.

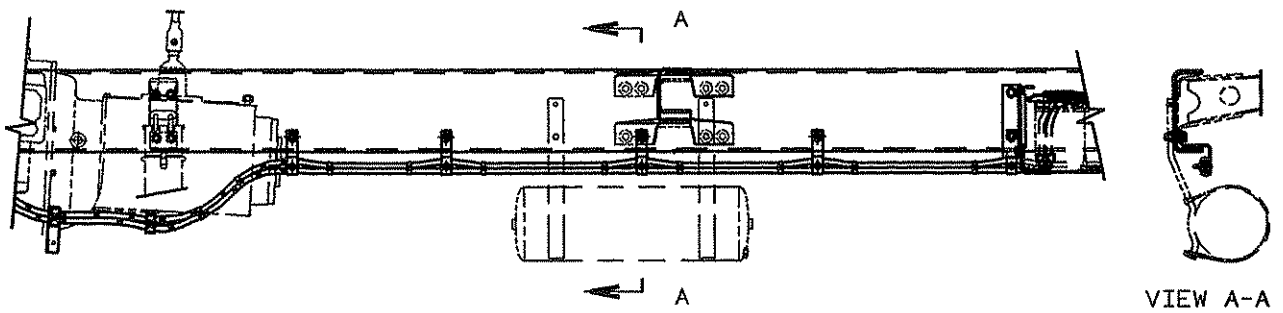
CABLE ROUTING:

CAUTION: WHEN ATTACHING THE CABLES TO THE BATTERIES, ALWAYS CONNECT THE POSITIVE CABLES FIRST, THEN NEGATIVE CABLES. THIS WILL DECREASE THE CHANCE OF SHORTING THE SYSTEM WHEN TIGHTENING THE BATTERY NUTS, ON A NEGATIVE GROUND SYSTEM.

CABLE ASSEMBLIES SHALL BE PROTECTED WITH CONVOLUTED TUBING (48-02217-XXX) FROM THE TERMINAL CRIMP TO WITHIN 2" OF THE FIRST CLAMPING POINT ON THE RAIL. THIS APPLIES TO CABLE CONNECTIONS AT THE STARTER AND THE BATTERIES.

EACH CABLE SHALL BE INDEPENDENTLY COVERED WITH CONVOLUTED TUBING. THE ENTIRE BATTERY CABLE SYSTEM SHALL NOT CONTAIN ANY SPLICES.

CABLES SHALL ROUTE ALONG AN UNOBSTRUCTED PATH FROM STARTER TO BATTERIES. A LINEAR PATH EXISTS ALONG THE RAIL BETWEEN BATTERY CABLE BRACKETS. FUEL LINES SHALL NOT BE ROUTED WITH OR CLAMPED TO BATTERY CABLES.



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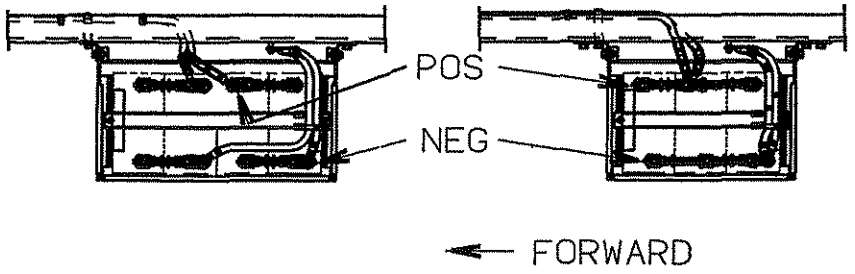
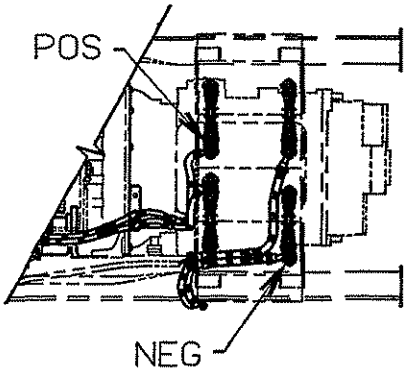
LOGON ID=

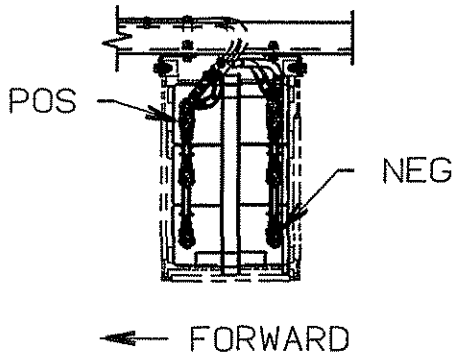
WHEN POSITIONING BATTERIES, POSITIVE POSTS SHALL ALWAYS BE LOCATED NEAREST THE RAIL (RAIL MOUNTED BOX) OR NEAREST THE BACK OF CAB (CROSS RAIL MOUNTED BOX). POSITIVE AND NEGATIVE CABLES SHALL NOT CROSS AT THE BATTERIES.

NEGATIVE CABLES SHALL ROUTE AROUND THE PERIMETER AREA OF THE BATTERIES THEN TOWARD THE RAIL. POSITIVE CABLES EXIT THE BATTERY BOX IN THE CENTER AREA THEN ROUTE TOWARD THE RAIL AND ON TO THE STARTER.CLAMPING IS REQ'D AT THE BACK OF ALL HIGH MOUNTED BOXES.





WHEN POSITIONING BATTERIES IN SHORT-SIDE-TO-RAIL BOXES, THE POSITIVE POSTS SHALL ALWAYS BE LOCATED FOREWARD OF THE NEGATIVE POSTS.



PROTECTIVE COATINGS:

PRIOR TO INSTALLING PLYWOOD LINERS IN THE BATTERY BOX ASSEMBLY, ALL SIDES OF THE LINER MUST BE COATED WITH "COMPOUND-L" (TEXACO) TO PREVENT DETERIORATION OF THE PLYWOOD BY BATTERY ACID.

BATTERY RETAINER ASSEMBLIES ARE TO BE DEGREASED, DRIED, THEN COATED PER ENGINEERING SPEC 49-00023-202.

GON ID=

COMPILED	H J R	SHOP PRACTICE BATTERY CABLE ROUTING AND INSTALLATION	SECTION NUMBER 33-06106
APPRV	E TRANS		PAGE 1 OF 1
ISSUE DATE	04/27/65	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
REV DATE	07/29/96		
CHG LTR	F		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-007 FOR BATTERY CABLE ROUTING AND INSTALLATION.

Compiled	H.J.R.	SHOP PRACTICE MODIFICATIONS REQUIRED FOR SYSTEM GROUND CHANGE	33-06106
Approved	D.E.C.		PA2024 56
Issued	4-28-66	Chg Ltr E FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1
Revised	01/08/91		

The following are modifications required for system ground change:

1. Speedometer and tachometer wiring
   a. (MOT)

2. Voltmeter wiring, water temperature, oil temperature, and fuel level gauges

3. Battery wiring (at starter)

4. Alternators:
   a. (MOT) wiring (this includes the ess)
   b. (DR) alternator and wiring (the engine harness)
   c. (LN) wiring (this includes harness)

5. Buzzer/Tri-diode

6. Radio:
   a. (MOT) selector
   b. (MSE) radio
   c. C/F Radio
   d. CB Radios

B

7. Stereo radi
   a. (MOT)

8. Anti ms:
   a. r relay warning, module and warning module wiring
   b. (ower relay and wiring
   c. (R power relay, CPR*, warning module and CPR* wiring

D

9. Alarm systems: NOTE - on systems that use a tri-diode, it must be changed.
   a. (KYS) module and wiring
   b. (PRY) module and wiring
   c. (RSC) module and wiring
   d. (SCT) no change
   e. (NYC) no change
   f. (ISP) wiring

10. Shutdown system (KYS)
    a. (KYS) module and wiring change

11. Jacobs Compression Brake wiring (diode reversed)

12. Heater:
    a. (FL) wiring of motor
    b. (RHD) wiring of motor

REMOVE & DESTROY

REVISED & RETYPED "C" CHG

*CPR=Computer power relay

The following are modifications required for system ground change: (Continued)

13. Air conditioners:
    a. (FL) wiring of motor
    b. (RDH) wiring of motor
    c. (FRI) wiring of motor
    d. (KYS) wiring change
    e. (MK) negative ground only

B 14. Roof mounted condensors with permanent magnet motors:
    a. (RDH) wiring of motor to be reversed
    b. (KYS) wiring of motor to be reversed

E 15. Electric Clocks:
    a. (BGI) wiring change
    b. (AGI) wiring change
    c. (RDH) wiring change
    d. (KYS) wiring change

16. Decals and wiring di

REMOVE & DESTROY

NOTE: Also check for customer speciality items such as citizen band raido, T.V., electric blanket, etc.

REVISED & RETYPED "A" CHG

The following are modifications required for system ground change: (Continued)

13. Air conditioners:
    a. (FL) wiring of motor
    b. (RDH) wiring of motor
    c. (FRI) wiring of motor
    d. (KYS) wiring change
    e. (MK) negative ground only

F

14. Roof mounted condensors with permanent magnet motors:
    a. (RDH) wiring of motor to be reversed
    b. (KYS) wiring of motor to be reversed.

E

15. Electric Clocks:
    a. (BGI) wiring change
    b. (AGI) wiring change
    c. (RDH) wiring change
    d. (KYS) wiring change

16. Decals and wiring diagrams

NOTE: Also check for customer speciality items such as citizen band raido, T.V., electric blanket, etc.

REVISED & RETYPED "A" CHG

A DRY CHARGED battery contains fully charged positive plates and negative plates separated by high-quality separators. The battery contains no electrolyte until it is activated for service in the field and therefore leaves the factory dry. Consequently, it is called a "dry-charge" battery.

INSPECTING CARTONS UPON ARRIVAL

Unless the batteries are kept dry until ready for use, they may lose a portion of their activating capacity due to moisture oxidizing the predried plates. Therefore, they must be properly stored to protect them against moisture.

Also, dry charged batteries must be handled with care to protect them against breakage. This may not be evident until the battery is activated by adding electrolyte. Therefore, battery cartons should be checked for evidence of either dampness or damage when the battery is received. If visual inspection of the carton indicates possible damage to the battery during transit or storage, it should be opened and the battery carefully checked.

HANDLING AND STORAGE

Batteries

The following precautions should be considered when storing dry charged batteries.

1. Store battery in a dry area which is protected from moisture.
2. Keep the battery in its shipping carton until activated.
3. Do not stack dry charged batteries in cartons more than four high.
4. Rotate battery stocks regularly to insure instant activation.
5. Maintain the storage area at approximately 60°F. or above.

Electrolyte

The following precautions should be considered when handling and storing electrolyte.

1. When storing electrolyte, avoid piling other material on containers.
2. The storage area should be maintained at 60°F or above.
3. Electrolyte should be used in an area where water is readily available for flushing in case the electrolyte comes into contact with the body.
4. Refer to instructions on the side of the electrolyte container for antidotes to use if electrolyte comes into contact with the body.

ACTIVATING DRY CHARGED BATTERIES

To prepare Delco "dry charge" batteries for service, use battery-grade acid electrolyte (1.265 sp. gr. at 80°F.) Electrolyte is commonly packaged in cartons or in five gallon containers.

If the five gallon bulk pack is used refer to instructions on side of container for adding electrolyte to battery. If individual cartons are used, fill the new battery with electrolyte as indicated below. Always activate the new battery before removing the old battery from the vehicle. For best performance, the temperature of the battery and the electrolyte should be at 60°F or above at time of activation.

1. Remove dry charged battery from its original carton.
2. Remove the vent plugs.
3. With the electrolyte carton right side up, break the perforations at the arrow and pull up this half of the carton top. *Do not attempt to remove the plastic bag from the container.* The bag is sealed to the container and any attempt to remove it may cause a rupture in the bag.
4. Cut a small opening in the corner of the bag as shown in Figure 2. Do not make the opening larger than required since a larger opening will increase the tendency of the electrolyte to spatter as it is emptied from the container.

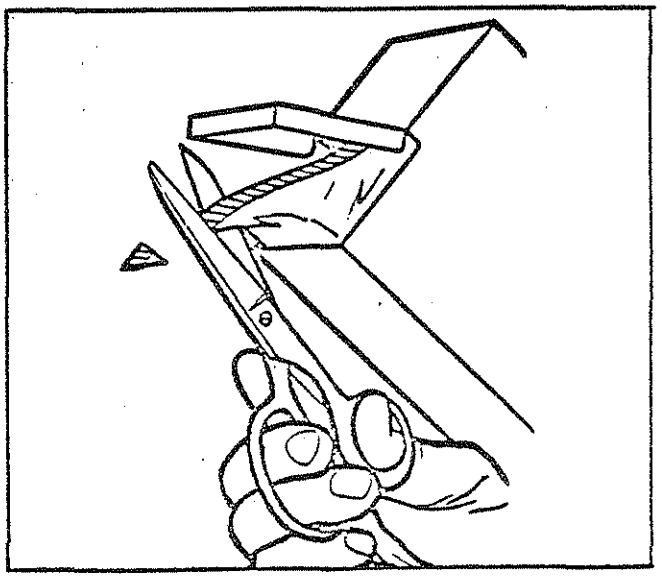


Figure 2 — Opening Electrolyte Container

From Delco-Remy Service Bulletin 7D-100, pp. 2, 3

5. Using a glass or acid-proof plastic funnel, fill each battery cell with electrolyte as shown in Figure 3. *Do not use a metal funnel for filling the battery.*

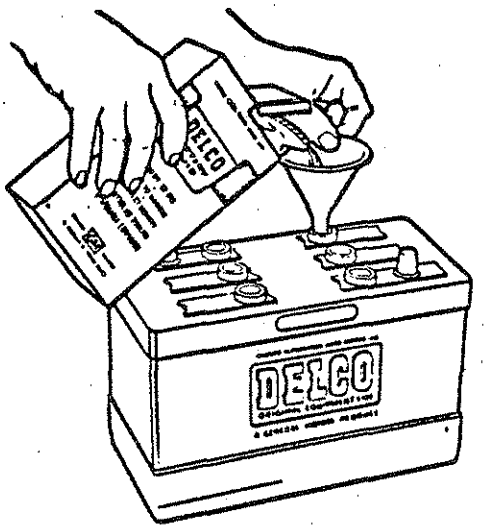


Figure 3 — Pouring Electrolyte Into Battery

6. All Delco batteries have cell covers with the "visual level fill" feature (Fig. 4). Guesswork is thus eliminated in filling the battery to the proper level. The cell is properly filled when the electrolyte level rises to the bottom of the split ring. Do not overfill.

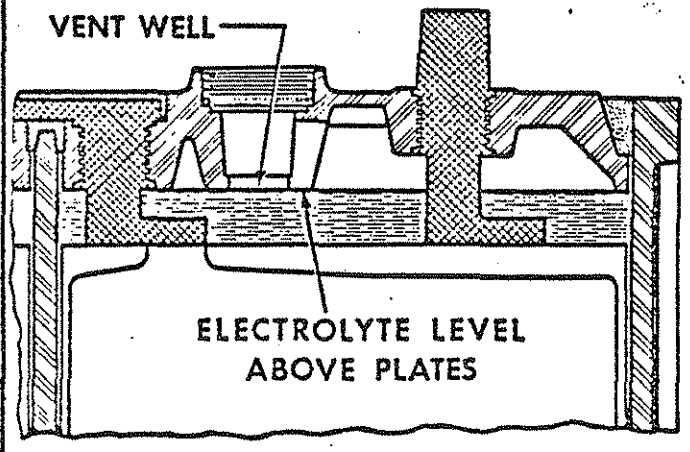


Figure 4—Top of Battery Cell and Cover Cut Away to Show Construction of "Visual Level Fill" Cell Cover and Proper Electrolyte Level Above Separators.

7. Should there be a case where the quantity of electrolyte is insufficient to fill all cells to the proper level, add electrolyte from another carton. Never add water when activating the battery.

   If the electrolyte level has dropped after the initial fill, due to the plates and separators absorbing acid, add additional electrolyte to bring the level to the split ring before installing battery in car.

8. Before discarding an electrolyte container, empty and rinse thoroughly with water to remove any electrolyte remaining in the container. Discarded packages containing electrolyte may prove to be dangerous or harmful to persons who are unfamiliar with the poisonous and corrosive characteristics of sulfuric acid electrolyte.

9. Be sure to date code the battery before installing it in the vehicle. Use a date code ring and gently stamp the code indicating the month and year when it is installed on top of the negative post of each battery.

10. After electrolyte has been added to a dry charged battery, it becomes a "wet" battery and should be maintained in the same way as any other "wet" battery. (See Wet Batteries.)

TESTS AFTER ACTIVATION

The Delco Dry Charge Battery may be put into service immediately after activation.

However, to insure good battery performance, the following activation tests are recommended:

1. Five minutes after adding electrolyte, check the open circuit voltage. More than 6 volts or more than 12 volts, depending upon the rated voltage, indicates the battery is ready for service. From 5 to 6 volts or from 10 to 12 volts indicates oxidized negative plates and the battery should be recharged before use. Less than 5 or less than 10 volts depending on the rated voltage, indicates a reverse cell or an open circuit and the battery should be replaced.

2. Check the specific gravity of all cells. If the specific gravity corrected to 80°F shows more than a thirty point (.030) drop from the initial filling with electrolyte, or if one or more cells gas violently after addition of electrolyte, the battery should be fully charged before use.

3. For best performance in cold weather (32°F or less), or if the battery and the electrolyte are not at 60°F or above at time of activation, warm the battery by boost charging as indicated below.

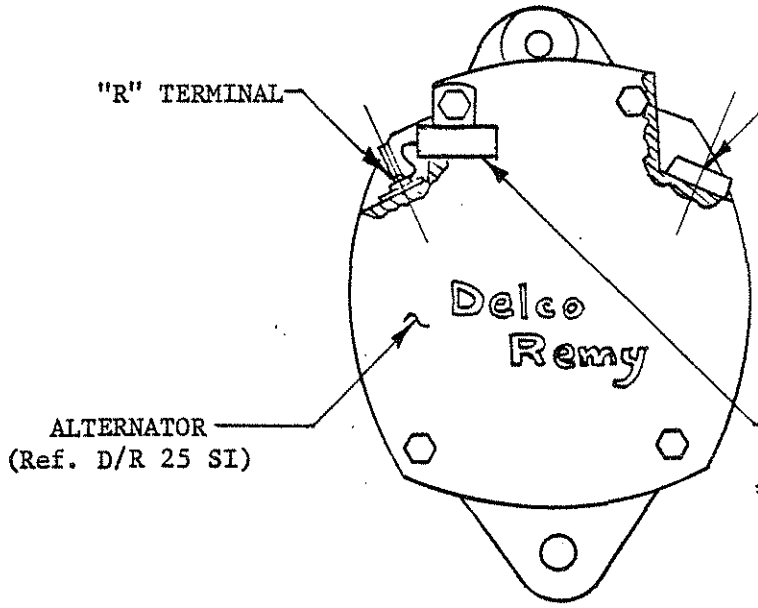
BOOST CHARGE RATES

Charge 6-volt and heavy duty 12-volt batteries a minimum of 10 minutes at 30 amperes (30 amperes × 10 minutes = 300 ampere-minutes). Charge all other 12-volt batteries a minimum of 10 minutes at 15 amperes (15 amperes × 10 minutes = 150 ampere-minutes). If charger will not give these rates, charge for an *equal number of ampere-minutes at best rate available.*

From Delco-Remy Service Bulletin 7D-100, pp. 2,3

Compiled	H.J.R.	SHOP PRACTICE ALTERNATOR, GENERAL	33-06108
Approved	BRAY		
Issued	9-10-73	Chg Ltr E **FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 1
Revised	6-23-80		

1. CAPACITOR MOUNTING ON ALTERNATOR (When Capacitor specified).



REAR VIEW OF ALTERNATOR

9-27-82
Pen Tom Moore
NO LONGER NEEDED

Mount capacitor on alternator by using upper lefthand backing plate mounting screw.* Hook wire lead of capacitor to "R" terminal of alternator.

2. PULLEY MOUNTING ON ALTERNATOR

- SEE 33-01122 FOR PROCEDURES

A. Removal and installation of the pulley on the alternator shaft must be by hand or by steady mechanical or hydraulic pressure. Do not use hammering action under any circumstances.

B. Run-up of pulley: it is permissible to use an impact wrench to run the retaining nut on until the pulley is just snug on the shaft.

C. Final tightening shall be by hand to the torque shown in the following table:

D Revised, redrawn & page 2 added 9-10-73

MANUFACTURER	SYMBOL	CURRENT RATING (Amperes)	TORQUE VALVE (Ft.-Lb.)
Leece-Neville	LN	ALL	70 - 80
Motorola	MOT	ALL	40 - 50
Delco-Remy	DR	62 75	58 - 62 70 - 80
Neihoff	NEH	60, 85-110	40 - 50 70 - 80

B

Caution: If rotor is held in a vise for this operation he careful not to tighten the jaws excessively or damage may result.

B

CHECK PRINT

DRAWN	LFB	TITLE	DRAWING NUMBER	
APPRV	DAJ	SHOP PRACTICE-ELECTRICAL CIRCUIT NUMBERS	33-06109	
DATE	10/14/99			
CATIA ORIGINAL		FREIGHTLINER CORPORATION PORTLAND, OREGON	SHEET 1 OF 1	CHG. LTR. M

THIS SHOP PRACTICE HAS been DISCONTINUED.

REPLACED BY 49-00097.

PRE RELEASE

CHG	JOB NO	DATE	BY	REVISION
M	PA2042-97	10/14/99	LFB	REVISED AND REDRAWN IN CATIA.

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
	1	00	BATTERY, 6V(NEG TERM)	STARTER, 12V(GND TERM)
B	1	00	BATTERY, 6V(NEG TERM)	STARTER, 24V(GND TERM)
	1	000	BATTERY, 12V(NEG TERM)	STARTER, 12V(GND TERM,3 BATTERY SYSTEM)
	1	00	BATTERY, 12V(NEG TERM)	STARTER, 12V(GND TERM,4 BATTERY SYSTEM)
B	1	00	BATTERY, 12V(NEG TERM)	STARTER, 24V(GND TERM)
C	1	00	BATTERY, 12V(NEG TERM)	STUD, CHASSIS GND(AIR START)
	2	00	BATTERY, 6V(POS TERM)	BATTERY, 6V(NEG TERM)
	3	00	BATTERY, 6V(NEG TERM)	SWITCH, SERIES–PARALLEL TERM #1(24V START)
E	3	00	BATTERY, 12V(NEG TERM) OF 24V BATTERY SET)	SWITCH, SERIES–PARALLEL TERM #1(24V START)
E	3	00	BATTERY, 12V(NEG TERM OF 24V BATTERY SET)	BATTERY, 12V(POS TERM OF 12V BATTERY SET)
F	3	00	BATTERY, 12V(NEG TERM)	BATTERY, 12V(POS TERM, T–R SYSTEM)
	5	00	BATTERY, 6V(POS TERM)	SWITCH, SERIES–PARALLEL TERM #2(24V START)
E	5	00	BATTERY, 12V(POS TERM, OF 24V BATTERY SET)	SWITCH, SERIES–PARALLEL TERM #2(24V START)
E	5	00	BATTERY, 12V(POS TERM OF 12V BATTERY SET)	STUD, 12V POWER(T–R SYSTEM)
E	5		12V TAP(24V START)	
B	6	00	BATTERY, 6V(POS TERM)	STARTER, 12V(BATT TERM)
B	6	00	BATTERY, 6V(POS TERM)	STARTER, 24V(BATT TERM)
B	6	000	BATTERY, 12V(POS TERM)	STARTER, 12V(BATT TERM, 3 BATTERY SYSTEM)
B	6	00	BATTERY, 12V(POS TERM)	STARTER, 12V(BATT TERM, 4 BATTERY SYSTEM)
B	6	00	BATTERY, 12V(POS TERM)	STARTER, 24V(BATT TERM)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	IO
E	6A	00	STARTER, BATT TERM	STUD, REMOTE JUMP START
	7	00	STARTER, GND TERM	STUD, CHASSIS FRAME GROUND (12V & 24V STARTERS)
B	8	8	STARTER, BATT TERM	SWITCH, SERIES–PARALLEL TERM #5(24V START)
B	9	10	STARTER(SOLENOID SWITCH TERM)	SWITCH, SERIES–PARALLEL TERM #4(24V START)
	13	10	SWITCH, SER–PAR TERM #6	STUD, GROUND
B	14	2–#8	STARTER, BATT TERM	JUNCTION BLOCK, CAB/CHASSIS (12V START)
B	14	2–#8	SWITCH, SER–PAR TERM #2	JUNCTION BLOCK, CAB/CHASSIS (12V START)
B	14	2–#8	BATTERY, POS TERM	JUNCTION BLOCK, CAB/CHASSIS (AIR START)
B	14	2–#8	JUNCTION BLOCK,CAB/CHASSIS	BUS BAR, CIRCUIT BREAKER
E	14		MAIN CAB FEED	
	14A	2–#8	SW,IGN CONTROLLED, MAG	BUS BAR, ISOLATED
B	15	12	BUTTON, START	CONNECTOR, CAB/CHASSIS
B	15	12	CONNECTOR, CAB/CHASSIS	SWITCH, MAG(12V STARTER)
B	15	12	CONNECTOR, CAB/CHASSIS	SWITCH, SER–PAR TERM #7
E	15		STARTER SOLENOID COIL FEED	
B	15A	12	SW,IGNITION (COIL TERM)	BUTTON, START
E	15A		STARTER PUSH BUTTON SW FEED	
E,B	15B	14	JUNCTION BLOCK, REMOTE CONTROL	RELAY, REMOTE CONTROL (COIL TERM)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
E,B	15C	14	BUTTON, START(CAB)	BUTTON, START (SLEEPER BOX)
E,B	15C	14	BUTTON,START (SLEEPER BOX)	SWITCH, ON/OFF(SLEEPER BOX)
E	15C	14	BUTTON,START(SLEEPER BOX)	SWITCH, TRANSMISSION NEUTRAL
E,B	15D	14	BUTTON, START(CAB)	SWITCH,TRANSMISSION NEUTRAL
E,B	15D	14	SWITCH, TRANSMISSION NEUTRAL	SWITCH,STARTER MAG
C	16	6	ALTERNATOR, OUTPUT TERM	BATTERY,POS TERM(AIR START)
C	16	6	ALTERNATOR, OUTPUT TERM	STARTER, 12V(BATT TERM)
	16	6	ALTERNATOR, OUTPUT TERM	SWITCH, SER–PAR TERM #2 (24V START)
	16	6	ALTERNATOR, OUTPUT TERM	SHUNT, AMMETER (12 & 24V START)
	16	6	SHUNT, AMMETER	STARTER, 12V(BATT TERM)
	16	6	SHUNT, AMMETER	SWITCH, SER–PAR TERM #2 (24V START)
C	16	6	SHUNT, AMMETER	BATTERY,POS TERM(AIR START)
E	16		ALTERNATOR OUTPUT	
F	16A	14	SHUNT AMMETER (ALTERNATOR OUTPUT TERM)	FUSE, INLINE, 15 AMP(COE)
F	16A	14	FUSE, INLINE, 15 AMP	GAUGE, AMMETER(COE)
F	16A	16	FUSE, INLINE, 15 AMP	GAUGE, AMMETER(CONV)
F	16A	16	SHUNT, AMMETER(ALTERNATOR OUTPUT SIDE)	FUSE, INLINE, 15 AMP(CONV)
F	16B	14	SHUNT,AMMETER(BATTERY SIDE)	FUSE, INLINE, 15 AMP(COE)
F	16B	14	FUSE, INLINE, 15 AMP	GAUGE, AMMETER(COE)
F	16B	14	SHUNT,AMMETER(SER–PAR SW SIDE)	FUSE,INLINE, 15 AMP(COE)
F	16B	16	SHUNT,AMMETER(BATT. SIDE)	FUSE,INLINE, 15 AMP(CONV)
F	16B	16	FUSE, INLINE, 15 AMP	GAUGE, AMMETER(CONV)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
F	16B	16	SHUNT,AMMETER(SER–PAR SW SIDE)	FUSE,INLINE, 15 AMP(CONV)
F	16C	6	AUX BAT CHARGE CIR	ISOLATOR UNIT/RELAY
F	16E	6	ISOLATOR, DUVAC(12V TERM)	STUD, CAB POWER
F	16F	6	ISOLATOR, DUVAC(24V TERM)	STARTER, 24V(B TERM)
B	18	12	SWITCH, IGNITION(COIL TERM)	CIRCUIT BREAKER, 10 AMP
C	18A	16	CIRCUIT BREAKER, 10 AMP	DIODE, BUZZER
E	18A	16	CIRCUIT BREAKER, 10 AMP (IGNITION CONTROLLED)	LIGHTBAR, PIN D1
C	18B	16	LAMP,WARNING(LOW AIR PRESS)	DIODE, BUZZER
C	18B	16	DIODE, BUZZER	SENSOR, LO AIR PRESS
E	18B	16	LIGHTBAR, PIN C14	SENSOR, LO AIR PRESS(PRIMARY)
E	18B	16	SENSOR, LOW AIR PRESS(PRIMARY)	SENSOR, LO AIR PRESS(SECNDY)
E	18B		LOW AIR PRESSURE INDICATOR FEED	
C	18C	16	LAMP, WARNING(HI WATER TEMP)	DIODE, BUZZER
C	18C	16	DIODE, BUZZER	SENSOR, HI WATER TEMP
E	18C	16	LIGHTBAR, PIN C1	SENSOR, HI WATER TEMP
E	18C		HIGH WATER TEMP INDICATOR FEED	
G	18CA	14	SW–ENG TEMP, ALARMSTAT	CIR BRKR–IGN SUPPLIED
J	18CB	14/16	SWITCH, HI-TEMP	RELAY SIG, HI-TEMP WARN.
C	18D	16	CIRCUIT BREAKER, IGN CONTR'D	GRAPH, EVENT STYLUS (HI WATER TEMP)
C	18E	16	GAUGE, MURPHY SWITCH	DIODE, BUZZER
B	18F	16	GAUGE, MURPHY SWITHC	DIODE
B	18F	16	DIODE	MODULE, CONTROL(S TERM)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
F	18G	12	SWITCH, IGN(ACC TERM)	CIRCUIT BREAKER, 10 AMP
C	19A	16	CIRCUIT BREAKER, 10 AMP	GAUGE, VOLTMETER
E	19A		VOLTMETER FEED	
B	20	14	CIRCUIT BREAKER, 15 AMP	SWITCH, LIGHTS
E	20		HEADLAMP RELAY COIL FEED	
E	20		HEADLAMP SWITCH SUPPLY(L)	
B	20A	14	CIRCUIT BREAKER, 15 AMP	SWITCH, LIGHTS
E	20A		HEADLAMP RELAY	POWER
F	20A		HEADLAMP SWITCH SUPPLY(R)	
B	20L	14	SWITCH, LIGHTS	SPLICE, INTO CIRCUIT 23D
B	20L	14	SPLICE, INTO CIRCUIT 23D	RELAY,LH HDLAMP(TERM #30)
F	20L		L/H HEADLAMP RELAY FEED	
B	20R	14	SWITCH, LIGHTS	SPLICE, INTO CIRCUIT 29D
B	20R	14	SPLICE, INTO CIRCUIT 29D	RELAY, RH HEADLAMP(TERM #30)
F	20R		R/H HEADLAMP RELAY FEED	
B	21	14	RELAY,LH HDLAMP(TERM #87)	SPLICE, INTO CIRCUIT 21B
B	21	14	SPLICE, INTO CIRCUIT 21B	LIGHT, LH HEADLAMP(HI BEAM)
E	21		HEADLAMP HIGH BEAM, LH	
B	21B	14	SPLICE,INTO CIRCUIT 21	LIGHT, INDICATOR(HI BEAM)
E	21B	14	RELAY,LH HDLAMP(TERM #87)	LIGHTBAR, PIN C16
E	21B		HIGH BEAM INDICATOR FEED	

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
B	21D	14	RELAY,RH HDLAMP(TERM #87)	LIGHT, RH HEADLAMP(HI BEAM)
E	21D		HEADLAMP HIGH BEAM, RH	
J	21H	16	AUX H-BEAM FLASH SWITCH	HI-BEAM FLASH SIGNAL
B	22	14	RELAY,LH HDLMP(TERM #87A)	LIGHT, LH HEADLAMP(LO BEAM)
E	22		HEADLAMP LOW BEAM, LH	
B	22D	14	RELAY,RH HDLMP(TERM #87A)	LIGHT, RH HEADLAMP(LO BEAM)
E	22		HEADLAMP LOW BEAM, RH	
B	23	10	CIRCUIT BREAKER, 30 AMP	RELAY, TRLR TAIL LAMP(TERM #30)
B	23	10	RELAY, TRLR TAIL LAMP (TERM #87)	JUNCTION BLOCK, 7-WAY
E	23		TRAILER MARKER & TAIL LAMP FEED	
B	23A	14	CIRCUIT BREAKER, 15 AMP	RELAY, TRACTOR MRKR/TAIL LAMP TERM #87)
B	23A	14	RELAY, TRACTOR MRKR/TAIL LAMP (TERM #30)	SPLICE, INTO CIRC'S 23T & 46
B	23A	14	SPLICE, INTO CIR'S 23T & 46	LIGHTS, TRACTOR TAIL LAMPS
E	23A		VEHICLE TAIL LAMP FEED	
F	23C	14	TAIL LIGHT	LIC PLATE LIGHT
B	23S	14	SPLICE, INTO CIRCUIT 20L	RELAY,TRACTOR MRKR/TAIL LAMP (TERM #85)
B,E	23D	14	RELAY, TRACTOR MRKR/TAIL LAMP (TERM #86)	SWITCH, INTERRUPT
F	23D		TRACTOR MARKER LAMP CONTROL	
B	23F	14	SWITCH, LIGHTS	RELAY, TRACTOR MRKR/TAIL LAMP (TERM #87A)
F	23F		TRACTOR MARKER LAMP RELAY(NC)	
B	23T	14	SPLICE, INTO CIRC'S 23A & 46	RELAY, TRLR TAIL LAMPS (TERM #85)
B,E,F	23T		TRAILER TAIL LAMP CONTROL	

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
J	23U	16	MRKR LT FLASH SW	MRKR LT FLASH SIGNAL
B	24	14	CIRCUIT BREAKER, 15 AMP	RELAY, HORN(TERM #30)
B	24	14	CIRCUIT BREAKER, 15 AMP	RELAY, HORN(TERM #85)
B	25	14	RELAY, HORN(TERM #86)	BUTTON, HORN
E	25		HORN BUTTON FEED	
B	26	14	RELAY, HORN(TERM #87)	HORN
E	26		HORN FEED	
F	27	12	SPL,CIRC#28(RD LMP RELAY)	LIGHT, LH ROADLIGHT
B	27	12	SWITCH, RH ROADLIGHT	SWITCH, LH ROADLIGHT
D	27	12	SWITCH, LH ROADLIGHT	CONNECTOR, CAB/CHASSIS
D,F	27	14	CONNECTOR, CAB/CHASSIS	LIGHT, LH ROADLIGHT
B	27A	12	CIRCUIT BREAKER	SWITCH, LH ROADLIGHT
B,F	27A	12	SWITCH, LH ROADLIGHT	LIGHT, LH ROADLIGHT
B	27B	12	SWITCH, LH ROADLIGHT	SWITCH, LH INBOARD ROADLIGHT
B,F	27B	12	SW,LH INBOARD ROADLIGHT	LIGHT, LH INBOARD ROADLIGHT
			ROADLIGHTS ONLY WITH LOW BEAM HEADLIGHTS	
F	27C	12	CIRCUIT BREAKER, 20 AMP	RELAY, ROADLIGHT(TERM #30)
F	27D	14	SWITCH, ROADLIGHT TOGGLE	RELAY, ROADLIGHT(TERM #85)
F	27E	14	RELAY, LH HEADLIGHT	SWITCH, ROADLIGHT TOGGLE
K	27E	14	ADDITIONAL FOG LIGHT POWER	SWITCH/RELAY
F	28	12	RELAY, ROADLIGHT(TERM #87)	SPLICE, CIRC #28
F	28	12	SPLICE, CIRC #28	LIGHT, RH ROADLIGHT

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
C	28	12	CIRCUIT BREAKER	SWITCH, RH ROADLIGHT
D	28	12	SWITCH, RH ROADLIGHT	CONNECTOR, CAB/CHASSIS
D	28	14	CONNECTOR, CAB/CHASSIS	LIGHT, RH ROADLAMP
E	28		ROADLAMP FEED	
B	28A	12	SWITCH, RH ROADLIGHT	SWITCH, RH INBOARD ROADLIGHT
B	28A	12	SW,RH INBOARD ROADLIGHT	LIGHT, RH INBOARD ROADLAMP
B	28B	12	RELAY, HI BEAM(COIL TERM)	RELAY, ROADLIGHT(COIL TERM)
K	28C	14	RELAY SIGNAL, DRIVING LIGHT	SWITCH
K	28D	14	RELAY SUPPLY, DRIVING LIGHT	FUSE/BRKR
K	28E	14	SWITCH SUPPLY, DRIVING LIGHT	LOW BEAM/TAIL LIGHT
K	28G	14	RELAY SIGNAL, REAR FOG LIGHT	SWITCH
K	28H	14	REAR FOG LIGHT POWER	SWITCH/RELAY
B	29	14	CIRCUIT BREAKER, 15 AMP	RELAY, PANEL LAMP(TERM #87)
B	29	14	RELAY, PANEL LAMP(TERM #30)	SPLICE, INTO CIRCUIT 46TB
B	29	14	SPLICE, INTO CIRCUIT 46T	RHEOSTAT, PANEL LAMP
E	29		INSTRUMENT LAMP SWITCH FEED	
B	29A	16	RHEOSTAT, PANEL LAMP	LIGHT, PANEL LAMPS
E	29A		INSTRUMENT LAMP FEED	
B	29B	14	SWITCH, PANEL LAMP(CIRC #29)	SWITCH, AUX PANEL LAMP
B	29D	14	SPLICE, INTO CIRCUIT 20R	RELAY, PANEL LAMP(TERM #85)
E,B	29D	14	RELAY, PANEL LAMP(TERM #86)	SWITCH, INTERRUPT
F	29D		PANEL LAMP CONTROL	
B	29F	14	RELAY, PANEL LAMP(TERM #87A)	SWITCH, LIGHTS
F	29F		PANEL LAMP RELAY(NC)	
K	29H	14	WARNING SIGNAL,LIGHTS ON & IGN ON	RELAY/SWITCH
K	29G	14	WARNING BUZZER POWER, LIGHT ON	RELAY/DOOR SWITCH/LIGHT/IGNITION
B	30	16	GAUGE, TRANSMISSION OIL TEMP	CONNECTOR, CAB/CHASSIS
B	30	14	CONNECTOR, CAB/CHASSIS	SENSOR, TRANSMISSION OIL TEMP
E	30		MAIN TRANSMISSION OIL TEMP GAUGE FEED	

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
B	31	16	GAUGE, AUX TRANS OIL TEMP	CONNECTOR, CAB/CHASSIS
B	31	14	CONNECTOR, CAB/CHASSIS	SENSOR, AUX TRANS OIL TEMP
	32	14	CIRCUIT BREAKER, 20 AMP	SWITCH, RH AUX HEATER
	32A	14	SWITCH, #1(RH AUX HEATER)	HEATER, RH AUX(HI SPEED)
	32B	14	SWITCH, #1(RH AUX HEATER)	HEATER, RH AUX (LO SPEED)
	32C	14	SWITCH, #2(RH AUX HEATER)	HEATER, RH AUX (HI SPEED)
	32D	14	SWITCH, #2(RH AUX HEATER)	HEATER, RH AUX(LO SPEED)
	33	14	CIRCUIT BREAKER, 20 AMP	SWITCH, HEATER
	33A	14	SWITCH, HEATER(H TERM)	RESISTOR, TERM #1
	33A	14	RESISTOR, TERM #1	MOTOR, HEATER(HI SPEED)
	33B	16	SWITCH, HEATER(L TERM)	RESISTOR, TERM #2
	33B	16	RESISTOR, TERM #2	MOTOR, HEATER(LO SPEED)
	33C	16	SWITCH, HEATER(M TERM)	RESISTOR, TERM #3
	33C	16	RESISTOR, TERM #3	MOTOR, HEATER(MED SPEED)
B	34	16	LAMP,WARNING(LO OIL PRESS)	SENSOR, LO OIL PRESS
C	34	16	DIODE, BUZZER	SENSOR, LO OIL PRESS
E	34	16	LIGHTBAR, PIN C4	SENSOR, LO OIL PRESS WRN
E	34		LOW OIL PRESSURE IND FEED	
C	34A	16	DIODE, BUZZER	SWITCH, HI OIL PRESS
	34A	16	SWITCH, Hi OIL PRESS	GRAPH
B	34B	14	LAMP, WARNING(OIL PRESS)	SWITCH, HIGH/LOW PRESS (CUMMINS BIG CAM III ENG)
B	34C		SEE CIRCUIT 18E	
B	34D		SEE CIRCUIT 18F	
	35	16	GAUGE, ENGINE OIL TEMP	SENSOR, ENGINE OIL TEMP
E	35		ENGINE OIL TEMP GAUGE FEED	
B,E	36	12	CIRCUIT BREAKER, 25 AMP	SWITCH, STOPLIGHT OR RELAY, STOPLIGHT

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
E	36		STOPLAMP SWITCH FEED	
E	36A	14	SWITCH, STOPLIGHT	LIGHTS, STOPLAMPS AT EOF (W/O INTEGRAL TURN SIGNALS)
C	36B	12	SWITCH, STOPLIGHT	JUNCTION BLOCK, TRAILER 7-WAY
E	36B		TRAILER STOPLAMP FEED	
	36C	12	SWITCH, STOPLIGHT	SWITCH, TURN SIGNAL
E	36C		TURN SIGNAL SWITCH STOP LAMP FEED	
	36D	12	SWITCH, STOPLIGHT	LIGHTS,STOPLAMP(BACK OF CAB)
E	36E	12	RELAY, STOPLIGHT	LIGHTS, STOPLAMP
E	36F	14	SWITCH, PARK BRAKE PRESS	RELAY, STOPLAMP(COIL SIDE) OR LAMP,INDICATOR(PARK BR)
E	36G	14	SWITCH, ENGINE BRAKE/RETARDER	RELAY, STOPLAMP(COIL SIDE)
G	36H	16	VIGIL FLASHER OVERRIDE	SW-OUTPUT, STOPLAMP
H	36H	16	LT BAR 4-WAY FLSHR OVERRIDE	STOP LTSW OUTPUT
B	37	12	CIRCUIT BREAKER, 20 AMP	SWITCH,TURN SIG(BROWN WIRE)
E	37	16	CIRCUIT BREAKER, 20 AMP	RELAY,FLASHER(COIL TERM#85)
E	37	12	CIRCUIT BREAKER, 20 AMP	RELAY,FLASHER(PWR TERM#30)
B	37A	14	FLASHER,TURN SIG(YEL WIRE)	SWITCH, REMOTE FLASHER
	38	14	SWITCH, TURN SIGNAL	JUNCTION BLOCK, TRAILER 7-WAY
	38		TRAILER TURN SIGNAL LAMP FEED, LH	
	38A	14	SWITCH, TURN SIGNAL	LIGHT, LH TURN SIG(AMBER, END OF FRAME)
	38B	12	SWITCH, TURN SIGNAL	CONNECTOR, CAB/CHASSIS
	38B	14	CONNECTOR, CAB/CHASSIS	LIGHT, LH TURN SIG(E.O.F.)
	38B		TRAILER STOPLAMP FEED	
	38B		LH STOP & TURN LAMP FEED	
	38C	14	SWITCH, TURN SIGNAL	LIGHT, LH TURN SIG(B.O.C.)
C	39	14	SWITCH, TURN SIGNAL	JUNCTION BLOCK, TRAILER 7-WAY
E	39		TRAILER TURN SIGNAL LAMP FEED, RH	
B	39A	14	SWITCH, TURN SIGNAL	LIGHT, RH TURN SIG(B.O.C.)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
B	39B	12	SWITCH, TURN SIGNAL	CONNECTOR, CAB/CHASSIS
D	39B	14	CONNECTOR, CAB/CHASSIS	LIGHT, RH TURN SIG(E.O.F)
E	39B		RH STOP & TURN LAMP FEED	
	39C	14	SWITCH, TURN SIGNAL	LIGHT, RH TURN SIGN(AMBER, END OF FRAME)
E	40	14	CIRCUIT BREAKER	SWITCH, WINDSHIELD FAN
E	40A	14	SWITCH, WINDSHIELD FAN	FAN,LH WINDSHIELD(LO SPEED)
E	40B	14	SWITCH, WINDSHIELD FAN	FAN,LH WINDSHIELD(HI SPEED)
E	40C	14	SWITCH, WINDSHIELD FAN	FAN,RH WINDSHIELD(LO SPEED)
E	40D	14	SWITCH, WINDSHIELD FAN	FAN,RH WINDSHIELD(HI SPEED)
E	40E	14	CIRCUIT BREAKER	RELAY, WINDSHIELD FANS
E	40E	14	RELAY, WINDSHIELD FANS	SWITCH, WINDSHIELD FANS
E	40F	14	SWITCH, SLEEPER BOX FAN	FAN, SLEEPER BOX
B	41	14	CIRCUIT BREAKER, 15 AMP	SWITCH, DOMELAMP
	41	14	SWITCH, DOMELAMP	LIGHT, DOMELAMP
	41		CAB DOME LAMP SWITCH FEED	
	41A	14	SPLICE, INTO CIRCUIT #41	LIGHT, BUNK DOMELAMP
K	41A	14	DOME LIGHT SWITCH POWER, SLEEPER	FUSE/BREAKER
	41B	14	SPLICE, INTO CIRCUIT #41	SWITCH,PASSENGER DOMELAMP
	41B	14	SWITCH, PASSENGER DOMELAMP	LIGHT, PASSENGER DOMELAMP
	41C	16	SPLICE, INTO CIRCUIT #41	LIGHT,AUX DRIVERS DOMELAMP
	41D	14	SPLICE, INTO CIRCUIT #41	LIGHT, AUX PASSGR. DOMELAMP
E	41E	14	CIRCUIT BREAKER	SWITH, 3-WAY(DOMELIGHT)
E	41F	14	SWITCH, CAB DASH 3-WAY	SWITCH, SLPR BOX 3-WAY
E	41G	14	SWITCH, SLPR BOX 3-WAY	SWITCH, CAB DASH 3-WAY
K	41H	14	DOME LIGHT POWER, SLEEPER	SWITCH
K	41J	14	READING LIGHT POWER, SLEEPER	SWITCH
K	41K	14	FLUOR. LIGHT POWER, SLEEPER, UPPER	SWITCH
K	41L	14	FLUOR. LIGHT POWER, SLEEPER, LOWER	SWITCH

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
B	42	16	GAUGE, FWD AXLE OIL TEMP	CONNECTOR, CAB/CHASSIS
B	42	14	CONNECTOR, CAB/CHASSIS	SENSOR, FWD AXLE OIL TEMP
	42		FWD REAR AXLE OIL TEMP GAUGE FEED	
B	43	16	GAUGE, REAR AXLE OIL TEMP	CONNECTOR, CAB/CHASSIS
B	43	14	CONNECTOR, CAB/CHASSIS	SENSOR, REAR AXLE OIL TEMP
E	43		REAR AXLE OIL TEMP GAUGE FEED	
J	44	14/16	SENSOR,AXLE TEMP.	GAUGE SIG.,AXLE TEMP,CTR REAR
E	45	12	CIRCUIT BREAKER	SWITCH, AUX TRAILER CIRCUIT
E	45		AUXILIARY TRAILER FEED	
E	45A	12	SW, AUX TRAILER CIRCUIT	CONNECTOR, 7-WAY(AUX PIN)
E	45A	14	SW, AUX TRAILER CIRCUIT	LAMP, WARNING(AUX TRLR CIRC)
E	45B	14	CIRCUIT BREAKER	SWITCH, AUX TRAILER CIRCUIT
E	45C	14	CIRCUIT BREAKER	RELAY, AUX TRLR CIRC(TERM #30)
B	46	14	SPLICE,INTO CIRCS#23A&23T	LIGHTS, CAB MRKR & ID LAMPS
E	46		CAB MARKER LAMP FEED	
B	46A	10	CIRCUIT BREAKER, 30 AMP	RELAY, TRLR MRKRS(TERM #30)
B	46A	10	RELAY, TRLR MRKRS(TERM #87)	JUNCTION BLOCK, 7-WAY
B	46E	14	SPLICE, INTO CIRCUIT #46	LIGHT, CAB MARKER(LH SIDE)
E	46E		SIDE MARKER LAMP FEED, LH	
B	46F	14	SPLICE, INTO CIRCUIT #46	LIGHT, CAB MARKER(RH SIDE)
E	46F		SIDE MARKER LAMP FEED, RH	
B	46T	14	SPLICE, INTO CIRCUIT #29	RELAY, TRLR MRKRS(TERM #85)
E,B	47	14	CONNECTOR, CAB/CHASSIS	SENDING UNIT, FUEL LEVEL
E,B	47	16	GAUGE, FUEL LEVEL	CONNECTOR, CAB/CHASSIS
E	47		FUEL LEVEL GAUGE FEED	
G	47A	14/16	GAUGE-FUEL, RH	SENSOR-LEVEL, FUEL, RH

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CL	CIRC NO	WIRE GA	FROM	TO
G	47B	16	GAUGE–FUEL, COMB LH/RH	SWITCH–SELECTOR, LH/RH
J	47C	14/16	SENSOR/RELAY,LOW FUEL LEVEL	LIGHT,LOW FUEL LEVEL
J	47C	14/16	SENSOR,LOW FUEL LEVEL	RELAY SIGNAL,LOW FUEL LEVEL
K	47E	14	FUEL LEVEL SENSOR POWER	IGNITION FUSE/BREAKER
B	52	12	CIRCUIT BREAKER, 20 AMP	SWITCH,IGN.(BATT TERM)
E	52		IGNITION SWITCH FEED(BATT)	
	52B	14	CIRCUIT BREAKER	SWITCH, ENGINE REMOTE CONTROL
	52C	10/12	STARTER BATTERIES	IGN. SWITCH BRKR PWR, ISOLATED
	54	16	RHEOSTAT, PANEL LAMP	GRAPH, SPEEDO & TACH
	55	16	CIRCUIT BREAKER	GRAPH, SPEEDO & TACH
	57	14	CIRCUIT BREAKER, 15 AMP	PLUG, CIGAR LIGHTER(CAB)
E	57		CIGAR LIGHTER FEED	
G	57A	14	PWR RCPT–12V, RH BUNK	CIRCUIT BREAKER
G	57B	14	PWR RCPT–12V, RH SLPR SHELF	CIRCUIT BREAKER
	57S	14	CIRCUIT BREAKER, 15 AMP	PLUG,CIGAR LGTR(SLPR BOX
F	58	12	CIRCUIT BREAKER, 20 AMP	SWITCH, LH AUX HEATER
E,F	58A	12	SWITCH, #1(LH AUX HEATER)	HEATER, LH AUX(HI SPEED)
E,F	58B	12	SWITCH, #1(LH AUX HEATER)	HEATER, LH AUX(LO SPEED)
E,F	58C	12	SWITCH, #2(LH AUX HEATER)	HEATER, LH AUX(HI SPEED)
E,F	58D	12	SWITCH, #2(LH AUX HEATER)	HEATER, LH AUX(LO SPEED)
B	60	14	SWITCH, TURN SIGNAL	LIGHT,LH FRONT TURN SIG.
E	60		FRONT TURN SIGNAL LAMP FEED, LH	
B	60A	14	SWITCH, TURN SIGNAL	LAMP, INDICATOR(LH TURN)
E	60A	16	SWITCH, LH TURN SIGNAL	LIGHTBAR, PIN C5
E	60A		TURN SIGNAL INDICATOR FEED, LH	

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CL	CIRC NO	WIRE GA	FROM	TO
	60B	14	LAMP, INDICATOR(LH TURN) LIGHT, LH FRONT TURN SIG LIGHT, TRAILER LH TURN SIG	SWITCH, REMOTE
	60C	14	LIGHT,LH REAR TURN(TRACTOR & TRUCK)	SWITCH, REMOTE FLASHER
H	60D	14	ALARM, TURN SIGNAL, L&R	TURN SIG CIR DIODES
B	61	14	SWITCH, TURN SIGNAL	LIGHT, RH FRONT TURN SIGNAL
E	61		FRONT TURN SIGNAL LAMP FEED, RH	
B	61A	14	SWITCH, TURN SIGNAL	LAMP, INDICATOR(RH TURN)
E	61A	16	SWITCH, RH TURN SIGNAL	LIGHTBAR, PIN C15
E	61B		TURN SIGNAL INDICATOR FEED, RH	
	61B	14	LAMP, INDICATOR(RH TURN) LIGHT, RH FRONT TURN SIG LIGHT, TRAILER RH TURN SIG	SWITCH, REMOTE
	61C	14	LIGHT,RH REAR TURN(TRACTOR & TRUCK)	SWITCH, REMOTE FLASHER
E	61T	14	SWITCH, TURN SIGNAL	ALARM, RH TURN
C,E	71	14	CIRCUIT BREAKER, 10 AMP	RELAYS,IGNITION CONTROLLED
E	71	14	CIRC BRKR, IGN CONTROLLED	ALTERNATOR,EXCITATION TERM
F	71		HEATER/AC CONTROL; H/L RELAY CONTROL	
B,E	71A	12	SWITCH, IGNITION(ACC TERM)	RELAY, RADIO(COIL TERM)
E	73	14	CIRCUIT BREAKER	SWITCH, UTILITY LIGHT
E	73A	14	SWITCH, UTILITY LIGHT	LAMP, INDICATOR(UTLY LAMP)
E	73A	16	SWITCH, UTILITY LIGHT	LIGHTBAR, OPTION PIN
B,E	73B	14	SWITCH, UTILITY LIGHT	LIGHT, UTILITY
			"FIRE TRUCK FLOOD LAMPS"	
E	73C	12	CIRCUIT BREAKER, 25 AMP	SWITCH, FLOOD LAMPS
E	73C	12	SWITCH, FLOOD LAMPS	JUNCTION BLOCK, 7-TERM
E	73D	12	SWITCH, FLOOD LAMPS	LAMP, PANEL INDICATOR
F	73E	14	CIRCUIT BREAKER, 15A (UTIL LAMP)	RELAY, UTIL LAMP(TERM #30)
F	73F	14	CIRCUIT BREAKER, WORK LIGHT (MILITARY VEHICLE)	RECEPT, PORTABLE WORK LT

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CL	CIRC NO	WIRE GA	FROM	TO
	74	8	SOLENOID, STARTER	SWITCH, STARTER MAG
E	74		STARTER SOLENOID FEED	
	75	14	SWITCH, STARTER MAG	STUD, GROUND
E	75		STARTER THERMO SWITCH FEED	
E	76	14	SWITCH, MIRROR HEAT	HEATER, LH MIRROR
E	76		HEATED MIRROR FEED, LH	
E	76A	14	SWITCH, MIRROR HEAT	HEATER, LH MIRROR(LOW)
E	77	14	SWITCH, MIRROR HEAT	HEATER, RH MIRROR
E	77		HEATED MIRROR FEED, RH	
E	77A	14	SWITCH, MIRROR HEAT	HEATER, RH MIRROR(LOW)
E	78	14	CIRCUIT BREAKER	LIGHT, SPOTLAMP
E	78A	14	SW, SPOTLAMP(LIGHT SIDE)	LAMP,INDICATOR(SPOTLAMP)
E	80	14	CIRCUIT BREAKER, 15 AMP	SWITCH, MIRROR HEAT
E	80		HEATED MIRROR SWITCH FEED	
E	80A	14	SWITCH, MIRROR HEAT	LAMP, INDICATOR(MIRROR HEAT)
E	80A	16	SWITCH, MIRROR HEAT	LIGHTBAR, OPTION PIN
E	80A		HEATED MIRROR IND FEED	
K	80B	14	MIRROR HEATER TIMER MODULE. POWER	SWITCH
K	80C	14	MIRROR HEATER TIMER MODULE SIGNAL	RELAY/SWITCH
	81C	16	CIRCUIT BREAKER	LAMPS, GAUGE & INDICATOR
E	81C		INSTRUMENT FEED	
	82	8	STARTER, BATT TERM	SWITCH, STARTER MAG
E	82		STRTR CONTROL SOLENOID FEED	

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CL	CIRC NO	WIRE GA	FROM	TO
	83	6	ALTERNATOR, GROUND TERM	STARTER, GROUND TERM
	84	14	SWITCH, HEAT/START	SOLENOID,GLO PLUGS(CAT ENG)
	85	10	STARTER, BATT TERM OR	SOLENOID, GLO PLUGS
			SERIES–PARALLEL SWITCH	
	86	14	SWITCH, IGNITION	SWITCH, INTER–AXLE LOCKOUT
B,E	87	16	LAMP, INDICATOR(INTER–AXLE)	CONNECTOR, CAB/CHASSIS
B,E	87	14	CONNECTOR, CAB/CHASSIS	SENSOR, INTER–AXLE
E	87	16	LIGHTBAR, OPTION PIN	SENSOR, INTER–AXLE
E	87		AXLE LOCK INDICATOR FEED	
F	87	16	CIRCUIT BREAKER, IGN CONTR'D	SENSOR, INTER–AXLE
	87	14	ALARM, BUZZER	SWITCH, HIGH RANGE WARNINGSWITCH, HIGH RANGE WARNING
L	87	16	SWITCH,INTERAXLE	IND LT,INTERAXLE LOCK
K	87A	16	AXLE LOCK SWITCH/BUZZER POWER	IGNITION FUSE/BREAKER
L	87A	16	IGN FUSE/BRKR	SWITCH/BZZR/LIGHT PWR
J	87B	14/16	SWITCH AXLE LOCK #1	LIGHT,IND.CNTRLD TRACTION #1
L	87B	16	SWITCH,TRCTN LOCK	IND LT SIG,TRCTN LOCK #1
J	87C	16	SWITCH,CNTRLD TRACTION	LIGHT,IND.CNTRLD TRACTION #1
L	87C	16	SWITCH,TRCTN LOCK	IND LT SIG,TRCTN LOCK #2
J	87D	14/16	SWITCH, CNTRLD TRACTION	LIGHT,IND.CNTRLD TRACTION #2
L	87D	16	SWITCH,TRCTN LOCK	IND LT SIG,TRCTN LOCK #3
J	87E	14/16	SWITCH, AXLE LOCK #3	LIGHT,IND.CNTRLD TRACTION #3
K	87F	16	AXLE DISENGAGE SIGNAL, AUTOMATIC	RELAY, TRANSMISSION ACTIVIATED
	88	14	SWITCH, STOPLAMP	SWITCH, AIR(MULTI–LUBER)
K	88	16	SWITCH/MODULE IGNITION POWER	IGNITION FUSE/BREAKER
	88A	14	SWITCH, AIR(MULTI–LUBER)	CONNECTOR, MULTI–LUBER
K	88A	16	SOLENOID VALVE POWER, AUTO LUBER	SWITCH/MODULE

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CL	CIRC NO	WIRE GA	FROM	TO
K	88B	16	SWITCH/MODULE CONSTANT POWER	FUSE/BREAKER
D	90	14	CIRCUIT BREAKER, 15 AMP	SWITCH, SANDERS
D	90A	14	SWITCH, SANDER	SANDERS
	90A	16	SWITCH, SANDER	LAMP, INDICATOR(SANDERS)
	91	14	CIRCUIT BREAKER	SWITCH,ENGINE WATER HEATER
	91	14	SWITCH, ENGINE WATER HEATER	HEATER,ENGINE WATER
	91	14	SWITCH, ENGINE WATER HEATER	LAMP,INDICATOR(WATER HTR)
B	91B	14	HEATER, BLOCK(220V ELEMENT)	TRANSFORMER, PRIMARY(16V)
B	91C	14	TRANSFORMER, SECONDARY(16V)	LAMP, WARNING
G	91D	14	HTR–WTR, CONTROL SIGNAL	SWITCH–OUTPUT SIGNAL
G	91E	14	SW–WTR HTR, PWR SUPPLY	HTR–WTR, PWR OUTPU
G,H	91F	14/16	LIGHT, IND, SIGNAL	HTR UNIT
H	91G	14/16	SIGNAL, CAB FAN	HTR UNIT
H	91H	10	SUPPLY, 12V, HTR, WTR	BAT +
B			**AIR DRYER HEATERS**	
B	94	14	CIRCUIT BREAKER	SWITCH, HEATER(PURGE VALVE)
E	94A	14	SWITCH,HEATER(PURGE VALVE)	HEATER, PURGE VALVE
B	94A	16	SWITCH,HEATER(PURGE VALVE)	LAMP, INDICATOR
B	94B	16	CIRCUIT BREAKER	MODULE, ELECTRONIC(DRAIN VALVE)
B	94B	16	MODULE, ELECTRONIC(DRAIN VALVE)	VALVE, DRAIN(RACOR)
B			**ANCHORLOK DRYER**	
B	94C	14	CIRCUIT BREAKER, 10 AMP	RELAY, IGN CONTR'D(TERM #30)
B	94C	14	RELAY,IGN CONTR'D(TERM#87)	HEATER, DRYER
A	95	16	RADIO, SPEAKER POWER	SPEAKER, LH FRONT(+ TERM)

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CL	CIRC NO	WIRE GA	FROM	TO
A	95A	16	RADIO, SPEAKER POWER	SPEAKER, RH FRONT(+ TERM)
	95C	16	RADIO, SPEAKER POWER	SPEAKER, LH REAR(+ TERM)
	95D	16	RADIO, SPEAKER POWER	SPEAKER, RH REAR(+ TERM)
	95E	16	SPEAKER, LH CAB(WIRING)	SPEAKER, LH, SLPR BOX(WIRING)
	95F	16	SPEAKER, RH CAB(WIRING)	SPEAKER, RH, SLPR BOX (WIRING)
	95G	16	RADIO, SPEAKER GROUND	SPEAKERS, ALL(– TERM)
B			**FOR FLOATING GROUND SPEAKERS ONLY**	
B	95J	16	RADIO,LH FRONT SPEAKER GND	SPEAKER, LH FRONT(– TERM)
B	95K	16	RADIO,RH FRONT SPEAKER GND	SPEAKER, RH FRONT(– TERM)
B	95L	16	RADIO,LH REAR SPEAKER GND	SPEAKER, LH REAR(– TERM)
B	95M	16	RADIO, RH REAR SPEAKER GND	SPEAKER, RH REAR(– TERM)
B			**FRONT SERIES CONNECTED SPEAKERS**	
B	95N	16	SPEAKER, LH FIRST(– TERM)	SPEAKER, LH SECOND(+ TERM)
B	95P	16	SPEAKER, RH FIRST(– TERM)	SPEAKER, RH SECOND(+ TERM)
	96	16	CIRCUIT BREAKER	LAMP,WARNING(LOW OIL LVL)
			PERRY LOW WATER LEVEL ALARM	
	97	14	CIRCUIT BREAKER	MODULE, CONT.(BROWN WIRE)
	97A	16	LAMP, WARNING	MODULE, CONT.(RED WIRE)
	97B	14	BUTTON, START	MODULE, CONT.(BLUE WIRE)
	97C	14	SENSOR, LOW WATER LEVEL	MODULE, CONT.(YELLOW WIRE)
B	98	12	CIRCUIT BREAKER, 20 AMP	RELAY, HTR HI SPEED(TERM #30)
	98	12	RELAY, HEATER–A/C(TERM #87)	SWITCH, HEATER–A/C
E	98		HEATER/AC FEED	
F	98	12	CIRCUIT BREAKER, 30 AMP	RELAY, HI SPEED HTR–A/C (TERM #87)
E	98	12	CIRCUIT BREAKER, 30 AMP	RELAY,HEATER–A/C(TERM #30)
E	98	12	SWITCH, HEATER–A/C JUMPER	SWITCH, HEATER–A/C

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CL	CIRC NO	WIRE GA	FROM	TO
B	98A	14	CIRCUIT BREAKER, 15 AMP	RELAY,A/C CLUTCH(TERM #30)
B	98A	14	RELAY, A/C CLUTCH(TERM #87)	SWITCH, LOW FREON PRESSURE
	98A	14	SWITCH, LOW FREON PRESSURE	CLUTCH, FREON COMPRESSOR
E	98A		A/C COMPRESSOR CLUTCH FEED	
			& DRIER REC FEED	
F	98A		THERMOSTAT, SLPR HTR-AC	RELAY, SLPR HTR-AC(TERM#85)
B	98B	14	SWITCH,LOW FREON PRESSURE	SOLENOID, SHUTTER(AIR VALVE)
	98D	12	SWITCH, CAB HEATER–A/C	RESISTOR, LOW SPEED
E	98D		BLOWER MOTOR SW FEED(LOW)	
	98E	12	SWITCH, CAB HEATER–A/C	RESISTOR, MED SPEED
E	98E		BLOWER MOTOR SW FEED(MED)	
F	98E		BLOWER MOTOR(MED–1)	
	98F	12	SWITCH, CAB HEATER–A/C	RESISTOR, HIGH SPEED
	98F	12	RESISTOR, HIGH SPEED	MOTOR, FAN(F/L A/C)
	98F	12	RELAY,CONTROL BOX(TERM #7)	MOTOR, FAN(SLEEPER BOX)
E	98F	12	SWITCH, CAB HEATER–A/C	RESISTOR, MED/HIGH SPEED
E	98F		BLOWER MOTOR HIGH SPEED	
F	98F	12	RELAY, HTR-AC(TERM #87)	MOTOR, FAN(SLEEPER BOX)
F	98F	12	SWITCH, HI SPEED	AUX HTR–AC MOTOR, ORANGE WIRE
F	98F		BLOWER MOTOR (MED–2)	
F	98G	12	RELAY, AUX CONTROL PANEL	SWITCH, LO SPEED
F	98G	12	SWITCH, LOW SPEED	AUX HTR–AC MOTOR, RED WIRE
	98H	14	RELAY,CONTROL BOX(TERM #9)	SOLENOID, FREON VALVE (SLEEPER BOX)
F	98H	12	RELAY, HTR–AC(TERM #87A)	SOLENOID, FREON VALVE (SLEEPER BOX)
	98L	12	SWITCH, FAN	RESISTOR, HIGH SPEED
	98L	12	RESISTOR, HIGH SPEED	MOTOR, FAN(HEATER-A/C COMBO)
F	98L		HIGH SPEED RELAY FAN RELAY CONTROL	
E	98L	12	SWITCH, HEATER–A/C	RELAY,HTR HI SPD(TERM #85)
B,E	98M	10	RELAY, AIR CONDITIONER	AIR COND. ROOF MOUNTED
E	98P	10	CIRCUIT BREAKER, A/C	RELAY, ROOF MOUNTED A/C
F	98R	12	RESISTOR, OUTPUT TERMINAL	RELAY, HI SPEED HTR–AC (TERM #87)

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CL	CIRC NO	WIRE GA	FROM	TO
F	98R		HIGH SPEED FAN RELAY (NC)	
C,E,F	98S	12	CIRCUIT BREAKER, 20 AMP	RELAY, HEATER-A/C(SLPR BOX, TERM #30)
F	98S	12	RELAY, HTR-AC(TERM #87)	RELAY,SLPR HTR-AC(TERM #30)
E,F	98S	12	RELAY, BOOSTER FAN(TERM #87)	SWITCH,ON-OFF(BOOSTER FAN)
E,F	98S	12	SWITCH, ON-OFF(BOOSTER FAN)	MOTOR, BOOSTER FAN
C,F	98S	12	RELAY, HEATER-A/C(TERM #87)	HEATER-A/C(SLPR BOX)
F	98S	12	CIRCUIT BREAKER, 20 AMP	RELAY,BOOSTER FAN(TERM #30)
F	98S	12	SWITCH, ON-OFF(BOOSTER FAN)	MOTOR, BOOSTER FAN
F	98T	10	RELAY, HTR HI SPEED(TERM #30)	MOTOR,FAN(HEATER-A/C COMBO)
F	98T		BLOWER MOTOR	
B,E	98Y	12	SWITCH, CAB A/C FAN	RESISTOR, LOW SPEED
F	98Y		BLOWER MOTOR LOW	
B	98Z	12	SWITCH, HEATER-A/C ON/OFF	SWITCH, THERMOSTAT
B	98Z	12	SWITCH, THERMOSTAT	RELAY, A/C CLUTCH(TERM #85)
	98Z	12	SWITCH, HEATER-A/C ON/OFF	SWITCH, HEATER-A/C FAN
F	98Z		A/C CLUTCH CONTROL: SHUTTER CONTROL	
B	99	12	SWITCH,IGNITION(COIL TERM)	SOLENOID, ENGINE SHUTDOWN
E	99		FUEL SOLENOID FEED	
B	99A	12	SWITCH,IGNITION(BATT TERM)	RELAY, CONTACT TERM
B	99A	12	RELAY, CONTACT TERM	SOLENOID, ENGINE SHUTDOWN
B	99B	12	SWITCH,IGNITION(AUX TERM)	SWITCH, ON-OFF(SLEEPER BOX)
B	99C	12	SWITCH,IGNITION(C TERM)	BUTTON, START(SLEEPER BOX)
B	99D	14	CIRCUIT BRKER,IGN CONTR'D	SWITCH, ANTI-THEFT
			SWITCH, ANTI-THEFT	SOLENOID, SECOND FUEL VALVE
E	99E	14	SWITCH,IGN. (COIL TERM)	MODULE, ENGINE SHUTDOWN OR RELAY, ENGINE SHUTDOWN (TERM #30)
F	99F	12	RELAY,IGN POWER(TERM #86)	BUTTON, STOP(AUX)
	101	12	BUS BAR	RELAY, ALTERNATOR SENSING

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CL	CIRC NO	WIRE GA	FROM	TO
	102	16	CIRCUIT BREAKER	SWITCH, PARKING LAMP
	102A	16	SWITCH, PARKING LAMP	LIGHT, LH PARKING LAMP
	103	16	SWITCH, PARKING LAMP	LIGHT, RH PARKING LAMP
E	108	14	CIRCUIT BREAKER	SWITCH, COURTESY LAMP
E	108A	14	CIRCUIT BREAKER	SWITCH, LH DOOR
E	108B	14	SWITCH, LH DOOR	LIGHT, DOMELAMP
E	108C	14	SWITCH, LH DOOR	LIGHT, LH COURTESY
E	109A	14	CIRCUIT BREAKER	SWITCH, RH DOOR
E	109B	14	SWITCH, RH DOOR	LIGHT, DOMELAMP
E	109C	14	SWITCH, RH DOOR	LIGHT, RH COURTESY
	113	16	CIRCUIT BREAKER	SWITCH,BAG COMPRTMT.LIGHT
	113B	16	SWITCH, BAG COMPARTMENT LIGHT	LIGHT, LH BAG COMPARTMENT
	113C	16	SWITCH, BAG COMPARTMENT LIGHT	LIGHT, RH BAG COMPARTMENT
G	113D	14	SW–BAG COMPARTMENT LIGHT	CIRC BRKR–BAG COMPT LIGHT
	116	6	STUD, CAB GROUND	STUD, CHASSIS GROUND
B	117	14	SENSOR, MAGNETIC PICK–UP	CONNECTOR, CAB/CHASSIS
B	117	16	CONNECTOR, CAB/CHASSIS	GAUGE, SPEEDOMETER
E	117		SPEEDOMETER(SENDER SIGNAL +)	
F	117B	14	SENSOR, DUAL LEAD(2ND PAIR)	LIGHTBAR,VIGIL III,PIN A04
B	118	14	SENSOR, MAGNETIC PICK–UP	CONNECTOR, CAB/CHASSIS
B	118	16	CONNECTOR, CAB/CHASSIS	GAUGE, SPEEDOMETER
E	118		SPEEDOMETER(SENDER SIGNAL –)	
F	118A	16	GAUGE, SPEEDO	GAUGE,DIXON TRIP ODOMETER (BLUE WIRE)

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CL	CIRC NO	WIRE GA	FROM	TO
F	118B	14	SENSOR, DUAL LEAD(2ND PAIR)	LIGHTBAR,VIGIL III,PIN B04
B,E,F	119	16	GAUGE, WATER TEMP(SIG)	CONNECTOR, CAB/CHASSIS
B,E,F	119	14	CONNECTOR, CAB/CHASSIS	SENSOR, WATER TEMP(SIG)
E	119		WATER TEMP GAUGE FEED	
	119A	14	GAUGE, REMOTE(WATER TEMP)	SENSOR, WATER TEMP
F	119B	16	GAUGE, WATER TEMP(GND)	CONNECTOR, CAB/CHASSIS
F	119B	14	CONNECTOR, CAB/CHASSIS	SENSOR, WATER TEMP(GND)
B,E	120	14	CIRCUIT BREAKER, 10 AMP	CONNECTOR, CAB/CHASSIS
B	12o	14	CONNECTOR, CAB/CHASSIS	SWITCH, TRANS BACK-UP LIGHT (RED WIRE)
E	120		BACK-UP LAMP SWITCH FEED	
B	120A	14	SW, TRANS BACK-UP LIGHT	LAMP, INDICATOR(BACK-UP LIGHT)
E	120B	14	SW, TRANS BACK-UP LIGHT (YELLOW WIRE)	LIGHT, BACK-UP
C			**ENGINE BRAKE, CUMMINS OR JACOBS**	
	121	14	CIRCUIT BREAKER, 10 AMP	SWITCH, CLUTCH
	121A	14	SWITCH, CLUTCH	SWITCH, THROTTLE
	121B	14	SWITCH, THROTTLE	SWITCH, #1(SELECTOR)
	121C	14	SWITCH, #1(SELECTOR)	SOLENOID, CYLINDERS 3 & 4 (CUM & DDE INLINE ENGINES)
	121C	14	SWITCH, #1(SELECTOR)	SOLENOID, CYLINDERS 1,2,3 & 4)(CUM & DDE V ENGINES)
	121C	14	SWITCH, #1(SELECTOR)	SOLENOID,CYLINDERS 1,2 &3 (CAT INLINE ENGINES)
G	121CA	14	MODULE-RPM O/R, INPUT	SWITCH-#1 SELECTOR
	121D	14	SWITCH, #2(SELECTOR)	SOLENOID,CYLINDERS 1,2,5&6 (CUM & DDE INLINE ENGINES)
	121D	14	SWITCH, #2(SELECTOR)	SOLENOID,CYLINDERS 5,6,7&8 (CUM & DDE V ENGINES)
	121D	14	SWITCH, #2(SELECTOR)	SOLENOID,CYLINDERS 4,5 & 6 (CAT INLINE ENGINES)
G	121DA	14	MODULE-RPM O/R, INPUT	SWITCH-#2 SELECTOR
F	121E	14	SWITCH, ON-OFF	SWITCH,3-1-2 SELECT(B TERM)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
			JACOBS ENGINE BRAKE(CANADA ONLY)	
	121F	14	SWITCH, CLUTCH	FUSE, 10 AMP
	121G	14	FUSE, 10 AMP	SWITCH, IGNITION(COIL TERM)
			JACOBS ENGINE BRAKE(RUAN LOW RPM PROTECTION)	
	121H	14	MODULE, BLACK WIRE	SWITCH,THROTTLE
	121J	14	MODULE, RED WIRE	SWITCH,CLUTCH
E	121K	14	CIRCUIT BREAKER, 10 AMP (CIRCUIT #15)	MODULE, YELLOW WIRE
	121L	14	MODULE,LO SPEED(WHITE WIRE)	MODULE, SENSING
	121M	14	MODULE, SENSING	MODULE, LO SPEED(WHITE WIRE)
	121N	14	SWITCH, THROTTLE	SWITCH, TIME DELAY
	121N	14	SWITCH, TIME DELAY	SWITCH, SELECTOR + TCFM
	121P	14	SWITCH, THROTTLE	SWITCH, TIME DELAY(POS TERM)
			JABOBS ENGINE BRAKE (WEITH MAGNETIC PROXIMITY SWITCH)	
	121A	14	SWITCH, CLUTCH (PROXIMITY	SWITCH, THROTTLE
			SWITCH, BLACK WIRE)	
	121R	14	CIRCUIT BREAKER, 10 AMP (IGNITION CONTROLLED)	RELAY
	121Q	14	CIRCUIT BREAKER, 10 AMP	SWITCH, CLUTCH (CANADA ONLY)
	121S	14	RELAY, TERM #30	RELAY, TERM #85
	121T	14	RELAY, TERM #85	SWITCH, PROXIMITY (RED WIRE)
	121U	14	RELAY, TERM #86	SWITCH, PROXIMITY (WHITE WIRE)
B			**JACOBS ENGINE BRAKE (DDE CONTROL)**	
B	121V	14	CIR BRKR, 10 AMP IGN CONTD	MODULE, CONTROL (RED WIRE)
B	121W	14	MODULE, CONTROL (WHITE WIRE)	SWITCH, CLUTCH
B	121X	14	MODULE, CONTROL (BLACK WIRE)	SWITCH, CLUTCH
E	121Y	14	SWITCH, THROTTLE	SWITCH, CRUISE CONTROL
H,E	121Z	16	IND LT, ENG. BRAKE	SWITCH, ENG. BRAKE

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
	122	14	SWITCH, BACK-UP LIGHT	ALARM, BACK-UP
F	122	14	CIRC BRKR, 10A, IGN CONTR'D	SWITCH, BACK-UP ALARM
F	122A	14	SWITCH, BACK-UP ALARM	ALARM, BACK-UP
	123	14	REGULATOR, LEECE-NEVILLE (FIELD TERM)	ALTERNATOR, FIELD TERM
J	123A	14	ALTRNTR,POS./FIELD TERM	REGULATOR, ALT. VOLT,POS
J	123B	14	REGULATOR, ALT. VOLT,POS	REGULATOR,ALTNTR VOLT,FIELD
J	123C	14	RELAY, FIELD TERM	ALTRNTR FIELD TERM
J	123D	14	ALTRNTR NEG	REGULATOR,ALTRNTR VOLT,NEG.
	124	14	REGULATOR, LEECE-NEVILLE (GROUND TERM)	ALTERNATOR, GROUND TERM
E,F	125	16	CIRCUIT BREAKER, IGN CONTR'D	SENSOR, PARKING LIGHT
F	125	16	SENSOR, PARKING LIGHT	LIGHTBAR, OPTION PIN
	125A	16	SW, STOPLAMP(SPRING BRAKE)	RELAY, STOPLAMP(COIL TERM,SPRING BRAKES ACTUATE STOP LIGHTS)
G	125B	14	BUZ-WRN, PARK BRAKE	SW-OUTPUT, PARK BRK
	130	12	CHARGER, TRANSFORMER-RECTIFIER (- TERM FOR NEG GND SYSTEM)	ALTERNATOR, OUTPUT TERM (+ TERM FOR NEG GND SYSTEM)
	130A	12	CHARGER, TRANSFORMER-RECTIFIER(PHASE TAPS)	ALTERNATOR, PHASE TAPS
	131	16	LAMP, WARNING(NO CHARGE)	RELAY, NO CHARGE
F	131A	16	CIRC BRKR, 10A, IGN CONTR'D	RELAY, NO CHARGE
	132	16	SWITCH, IGNITION	LAMP, WARNING(NO CHARGE)
	137	16	ALTERNATOR, PHASE TAP	RELAY, NO CHARGE LAMP
	137	16	RELAY, ADLO	LAMP, NO CHARGE(ADLO SYSTEM)
E	138	14	ALTERNATOR, PHASE TAP	RELAY, ADLO
E	139	14	RELAY, ADLO	SWITCH, STARTER MAG

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
	139A	14	CIRCUIT BREAKER, 10 AMP	RELAY, ADLO(AIR START)
	139A	14	RELAY, ADLO(AIR START)	SOLENOID, LOCK-OUT(AIR START)
A	139B	16	BUTTON, START	RELAY, ADLO
	140	16	GAUGE, ELECT OIL PRESS	SENSOR, OIL PRESS
C	141	14	CIR BREAKER, IGN CONTR'D	RELAY, ADLO CONTACTS
B	141	14	RELAY, ADLO(CONTACTS)	SOLENOID, ADLO(AIR START)
	147	16	CIRCUIT BREAKER, 10 AMP	SWITCH, MANUAL OVERRIDE (THERMATIC FAN)
	148	16	SWITCH, MANUAL OVERRIDE	LAMP, WARNING(THERMATIC FAN)
	149	16	SWITCH, MANUAL OVERRIDE	SOLENOID, MANUAL OVERRIDE
F	149A	14	SWITCH, MANUAL OVERRIDE	LIGHTBAR, PIN #C13
F	149B	14	CIR BRKR,IGN CONTR'D	SWITCH MANUAL OVERRIDE
H	149C	14	ENG. FAN SWITCH/RELAY	PARK BRAKE SWITCH
B	150	14	LAMP,WARNING(LO OIL PRESS)	ALARM, BELL(KYSOR LO OIL)
			KYSOR HIGH WATER TEMP SHUTDOWN	
B	150A	14	MODULE, CONTROL(TERM #3)	SENSOR, ALARMSTAT(NC TERM)
B	150B	14	SENSOR, ALARMSTAT(NC TERM)	SOLENOID, ENGINE SHUTDOWN
B	150C	14	ALARM, KYSOR BELL	SENSOR, ALARMSTAT(NO TERM)
	150D	14	SENSOR, ALARMSTAT(NO TERM)	LAMP,WARNING(HI WATER TEMP)
			KYSOR LOW OIL PRESSURE ALARM	
B	150E	14	CIRCUIT BREAKER	ALARM, KYSOR BELL
B	150E	14	ALARM, KYSOR BELL	SENSOR, LOW OIL PRESS
	150F	14	SENSOR, ALARMSTAT(NC TERM)	MODULE, CONTROL(TERM #1,KYSOR AUTO OVERRIDE SYSTEM)

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CL	CIRC NO	WIRE GA	FROM	TO
	150F	14	SENSOR, ALARMSTAT(NC TERM)	SWITCH, MANUAL OVERRIDE (POWER SIDE)
E	150F		ALARMSTAT (N.C.) SHUTDOWN TERMINAL FEED	
	150G	14	MODULE, CONTROL(TERM #3)	ALARM, KYSOR BELL
	150G	14	MODULE, CONTROL(TERM #3)	LAMP,WARNING(LO WATER LVL)
	150H	14	SWITCH, OIL PRESSURE	SWITCH, HI TEMP(NYCAL)
E	150J	16	DIODE, BUZZER(FEMALE TERM)	ALARM, WARNING BELL
E	150K	16	DIODE, BUZZER(MALE TERM)	SENSOR,PRESRSTCT(NC TERM)
E	150L	16	DIODE, BUZZER(MALE TERM)	SENSOR,ALARMSTAT(NO TERM)
	150L	16	ALARM, WARNING BELL	DIODE
	150L	16	DIODE	SENSOR,ALARMSTAT(KYSOR SYS)
	150M	14	SENSOR, ALARMSTAT(C TERM)	SENSOR,PRESSURESTAT(NO TERM)
E	150M		ALARMSTAT TO PRESSURESTAT OR TEMP SW GROUND	
	150N	16	SENSOR,PRESRSTAT(NO TERM)	MODULE, CONTROL(TERM #3, KYSOR AUTO OVERRIDE)
	150N	16	SENSOR,PRESRESTAT(NO TERM)	SWITCH, MANUAL OVERRIDE
	150Q	14	CIRCUIT BREAKER, 10 AMP	MODULE 4 TERM(TERM #1)
	150Q	16	CIRCUIT BREAKER, 10 AMP	MODULE, 6 TERM(TERM #4)
	150Q	16	CIRCUIT BREAKER, 10 AMP	SWITCH, MANUAL OVERRIDE
E	150Q	16	CIRC BRKR,10 AMP IGN CONTD	RELAY, SHUTDOWN(TERM #30)
E	150Q	16	RELAY, SHUTDOWN(TERM #30)	RELAY, SHUTDOWN(TERM #85)
E	150R	14	SWITCH, START	MODULE, CONTROL(TERM #2)
E	150R	16	SWITCH, START	LIGHT BAR, PIN #C8
	150S	16	SENSOR,PRESSURESTAT(C TERM)	MODULE, 6 TERM(TERM #4)
	150S	16	SWITCH, PRESSURE	MODULE, NYCAL(TERM #4)
B	150T	14	CIRCUIT BREAKER	LAMP, LOW WATER(ROADWAY)
	150X	16	CIRCUIT BREAKER, 10 AMP	SWITCH, MANUAL OVERRIDE (NYCAL)
C	150Y	16	SWITCH, MANUAL OVERRIDE	SOLENOID, ENGINE SHUTDOWN
	151	10	CIRCUIT BREAKER	INVERTER, 110V INPUT
	153	14	SWITCH, DECLUTCH	SOLENOID, DECLUTCH VALVE

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CL	CIRC NO	WIRE GA	FROM	TO
	153A	14	CIRCUIT BREAKER, 10 AMP	SWITCH, DECLUTCH(FRONT AXLE)
	154	14	LAMP, WARNING(AIR LIFT)	SWITCH, ACTUATION
B	155	14	SWITCH, ACTUATION	SOLENOID, AIR LIFT VALVE
C	157	14	CIRCUIT BREAKER, 10 AMP	SWITCH, POWER MIRROR
C	157A	14	SWITCH, LH POWER MIRROR	MOTOR, LH MIRROR(IN)
C	157B	14	SWITCH, LH POWER MIRROR	MOTOR, LH MIRROR(OUT)
C	157C	14	SWITCH, RH POWER MIRROR	MOTOR, RH MIRROR(IN)
C	157D	14	SWITCH, RH POWER MIRROR	MOTOR, RH MIRROR(OUT)
C	157E	14	SWITCH, RH POWER MIRROR	SW,RH LIMITER(RED WIRE)
C	157F	14	SWITCH, RH POWER MIRROR	SW,RH LIMITER(BLACK WIRE)
	158	14	MODULE, 6 TERM(TERM #3)	SOLENOID, ENGINE SHUTDOWN
	158B	16	BUTTON, START	LAMP,WARNING(LO WATER LVL ISSPRO LO WATER ALARM)
	158C	16	SENSOR, PRESSURESTAT(NO TERM)	SOLENOID, ENGINE SHUTDOWN
	158D	16	MODULE, 4 TERM(TERM #3)	LAMP,WARNING(LO WATER LVL)
	158D	16	MODULE, 4 TERM(TERM #3)	RELAY, LO WATER(B TERM)
E	158E	16	DIODE, BUZZER(MALE TERM)	LAMP,WARNING(LO WATER LVL)
	158F	16	MODULE, 4 TERM(TERM #1)	LAMP,WARNING(LO OIL PRES)
	158F	16	MODULE, 4 TERM(TERM #1)	LAMP,WARNING(HI WATER TMP)
	158F	16	MODULE, 4 TERM(TERM #1)	LAMP,WARNING(LO WATER LVL)
	158G	16	MODULE, 4 TERM(TERM #1)	ALARM, KYSOR BELL
E	158H	16	DIODE, BUZZER(MALE TERM)	RELAY, LO WATER(C TERM)
	158J	16	LAMP, WARNING(HI WATER TEMP)	SENSOR, KYSOR ALARMSTAT
E	158K	16	MODULE, 6 TERM(TERM #5)	DIODE, BUZZER(MALE TERM)
B	158L	16	CIRCUIT BREAKER, 10 AMP	RELAY, KYSOR BELL(COIL TERM)
	159	16	LAMP,WRNING(THERMATIC FAN)	SENDING UNIT, THERMATIC FAN

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CL	CIRC NO	WIRE GA	FROM	TO
	160	14	CIRCUIT BREAKER	INVERTER, 110V TO 12V
B,E	162	16	GAUGE, ELECT TACHOMETER	CONNECTOR, CAB/CHASSIS
B,E	162	14	CONNECTOR, CAB/CHASSIS	SENSOR, FLYWHEEL MAG PICK-UP
E	162		TACHOMETER(SENDER SIGNAL +)	
B,E	163	16	GAUGE, ELECT TACHOMETER	CONNECTOR, CAB/CHASSIS
B,E	163	14	CONNECTOR, CAB/CHASSIS	SENSOR, FLYWHEEL MAG PICK-UP
E	163		TACHOMETER(SENDER SIGNAL -)	
	164	16	LAMP,WRNING(FRT AXLE DRIVE)	SENDING UNIT
B			**ETHER STARTING AIDS**	
B,E	166	12	SWITCH, IGNITION(ACC TERM)	SWITCH, ETHER START
E	166		ETHER INJCTR PUSHBUTTON FEED	
B,E	166A	12	SWITCH, ETHER START	SOLENOID, ETHER CYLINDER VALVE OR THERMOSTAT SWITCH
E	166A		ETHER INJECTOR SOLENOID FEED	
B,E	166A	12	SOLENOID, ETHER CYL VALVE	SWITCH, THERMOSTAT
E	166B		ETHER INJ THERMOSTAT FEED	
B,E	166C	12	SWITCH, THERMOSTAT	GROUND
K	166C	14	SWITCH, THERMOSTAT SIGNAL	ETHER SOLENOID VALVE/GROUND
B,E	166D	12	CIRC BRKR, CONSTANT POWER	MODULE, WEBB ETHER COUNTER
B,E	166E	12	MODULE, WEBB ETHER COUNTER	GROUND
B,E	166F	12	MODULE, WEBB ETHER COUNTER	SWITCH, RESET
B,E	166F	12	SWITCH, RESET	GROUND
D,E	166G		NEVER USED	
	167	14	SWITCH, IGNITION(ACC TERM)	OIL LEVELER, REN
B	168	16	SOURCE, +12V(ENGINE)	METER, ENGINE HOUR

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CL	CIRC NO	WIRE GA	FROM	TO
E	168		HOURMETER FEED	
K	168	16	ENGINE HOUR METER POWER	IGNITION FUSE/BREAKER OR SWITCH
K	168A	16	PRESSURE SWITCH SUPPLY	IGNITION FUSE/BREAKER OR SWITCH
E,F	170	16	CIRCUIT BREAKER, IGN CONTR'D	SENSOR, FIFTH WHEEL SLIDE
E	170		5TH WHEEL INDICATOR FEED	
F	170	16	SENSOR, 5TH WHEEL SLIDE	LIGHTBAR, OPTION PIN
A			**CAT BRAKESAVER**	
	171	14	SWITCH, IGNITION(COIL TERM)	CIRC BRKR,10 AMP(BRAKESVR)
	171A	14	CIRCUIT BREAKER, 10 AMP	SW, SELECTOR(MAN OR AUTO)
	171B	14	SWITCH, SELECTOR(MAN OR AUTO)	SOLENOID, VALVE
	171C	14	SOLENOID, VALVE	SWITCH, CLUTCH
	171D	14	SWITCH, CLUTCH	SWITCH, THROTTLE
	171E	14	SWITCH, TOGGLE(BRAKESAVER)	FUSE,10 AMP(CANADA ONLY)
	171F	14	FUSES 10 AMP(CANADA ONLY)	SW, IGNITION(COIL TERM)
	171G	14	SENSOR, OIL TEMP	GAUGE, OIL TEMP
	171H	14	CIRCUIT BREAKER	LAMP, WARNING
E	171H	14	LAMP, WARNING	SWITCH, BRAKESAVER (ILLUMINATE PRESSURE)
	172	16	CIRCUIT BREAKER	CLOCK, ELECTRIC
E	172		ELECTRIC CLOCK OR TACHOGRAPH FEED	
	172A	16	CLOCK, RED DOT	ALARM
	172B	14	CIRCUIT BREAKER	SWITCH, BATTERY CUTOFF (POWER SIDE)
	173	14	MODULE, CONTROL	SENSOR, LOW WATER LEVEL
E	173		LOW WATER LEVEL PROBE	
			NYCAL ALARM SYSTEM	
	174	14	MODULE, CONTROL(TERM #2)	ALARM, BUZZER
	174	14	ALARM, BUZZER	LAMP, WARNING

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CL	CIRC NO	WIRE GA	FROM	TO
	174A	14	MODULE, CONTROL(TERM #5)	SENSOR, HI WATER TEMP
	174B	14	MODULE, CONTROL(TERM #3)	ALARM, BUZZER
	174B	14	ALARM, BUZZER	LAMP, WARNING
	174D	14	MODULE, CONTROL(TERM #6)	SWITCH, OVERRIDE
	175	14	ALARM, BUZZER	SWITCH, IGNITION(COIL TERM, NYCAL LOW WATER ALARM)
	175	14	MODULE, CONTROL(TERM #1)	SWITCH, OVERRIDE(POWER SIDE)
			ROBERT SHAW ALARM SYSTEM	
	177	14	FUSE, 4 AMP	PROBE,LOW WATER(POWER TERM)
	177A	14	PROBE, LOW WATER(SIG TERM)	LAMP, WARNING(LOW WATER)
	177B	14	PROBE, LOW WATER(TEST TERM)	SWITCH, TEST
E	177C	14	PROBE, LOW WATER(SIG TERM)	DIODE, BUZZER
E	177E	14	BATTERY, SOURCE	RELAY, CONTACT
	177F	16	RELAY, CONTACT	LAMP, WARNING
	177F	16	RELAY, CONTACT	ALARM, BUZZER
A,E	177G	14	DIODE, BUZZER	PROBE, LOW OIL(SIG TERM)
A	177G	14	LAMP, WARNING	PROBE, LOW OIL(SIG TERM)
A	177H	14	CIRCUIT BREAKER, 10 AMP	PROBE, LOW OIL(+ TERM)
A	177J	16	BUTTON, START	RELAY, COIL SIDE
A	177K	14	PROBE, LOW OIL(TEST TERM)	RELAY, POWER SIDE
B			**DELAYED ENGINE SHUTDOWN**	
B	178	14	SWITCH, IGNITION(BATT TERM)	TIMER, SHUTDOWN
B	178A	14	TIMER, SHUTDOWN(BLUE WIRE)	SWITCH,IGNITION(COIL TERM)
B	178B	14	CIRCUIT BREAKER	TIMER, SHUTDOWN
B	178C	14	TIMER, SHUTDOWN	SOLENOID, ENGINE FUEL
B	178D	12	CIRCUIT BREAKER, IGN CONTR'D	RELAY, TIMER(POWER IN)
B	178D	12	RELAY, TIMER(POWER OUT)	BUTTON,START(IGNITION SIDE)
K	178E	14	IDLE LIMIT MODULE TEMPERATURE SIGNAL	TEMPERATURE SWITCH/MODULE
			PSM/#1000	

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CL	CIRC NO	WIRE GA	FROM	TO
	179	14	SWITCH, IGNITION	CIRCUIT BREAKER, 10 AMP
	179A	14	CIRCUIT BREAKER, 10 AMP	SWITCH, ON-OFF
	179B	14	SWITCH, ON-OFF	GLO-PLUGS
			CORNING GLASS WARNING SYSTEM	
	180	14	CIRCUIT BREAKER, 10 AMP	MODULE, CONVERTER BOXES
	180A	14	MODULE,CONV BOX(LOW FUEL)	LAMP, WARNING(LOW FUEL)
	180B	14	MODULE,CONV BOX(LOW OIL)	LAMP, WARNING(LOW OIL)
	180C	14	MODULE,CONV BOX(LOW WATER)	LAMP, WARNING(LOW WATER)
			FUEL PRESSURE SENSOR	
B,E	182	16	CIRC BRKR,10 AMP(CONST PWR)	LAMP, INDICATOR
B	182A	16	LAMP, INDICATOR	SWITCH, FUEL PRESSURE
	183A	16	LAMP, INDICATOR(AIR CLNR)	SWITCH, VACUUM
	184	12	SWITCH, IGNITION(COIL TERM)	SWITCH, NEUTRAL SAFETY (HT 70 TRANSMISSION)
	184A	12	SWITCH, NEUTRAL SAFETY	SOLENOID, AIR VALVE(AIR START)
A			**BURGLAR ALARM**	
A,E	185	14	CIRC BRKR,10 AMP(CONST PWR)	UNIT, ALARM
	185A	14	SWITCH, BURGLAR ALARM	UNIT, ALARM
	185B	14	SWITCH, RH DOOR	UNIT, ALARM
	185C	14	SWITCH, LH DOOR	UNIT, ALARM
	185D	14	SWITCH, CAB MOUNTED	UNIT, ALARM
A	185E	14	LAMP, WARNING	UNIT, ALARM
A	185F	14	HORN, ALARM	UNIT, ALARM
A,E	185G	14	SWITCH, DOOR	CIRCUIT BREAKER,CONST POWER
A,E	185H	14	CIR BRKR, CONST POWER	LAMP, INDICATOR
E	185J	14	CIRCUIT BREAKER, IGN COIL	UNIT, ALARM
E	185K	12	SWITCH, IGNITION(ACC TERM)	UNIT, ALARM

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CL	CIRC NO	WIRE GA	FROM	TO
	186		SEE CIRCUIT #140	
	187	14	SWITCH, IGNITION(COIL TERM)	SWITCH, HORTON FAN
	188	14	BUS BAR	CIRCUIT BREAKER
C	188	14	CIRCUIT BREAKER	RELAY, ANTILOCK POWER
	189	14	RELAY, ANTILOCK POWER	MODULE, ANTILOCK WARNING
E	190	14	CIRCUIT BREAKER	HTR,EJECTOR(GRAGHAM-WHITE)
	191	14	CIRCUIT BREAKER	SWITCH, GLO-PLUG
	191A	14	SWITCH, GLO-PLUG	RESISTOR
	191B	16	SWITCH, GLO-PLUG	LAMP, WARNING(GLO-PLUG)
	191C	14	RESISTOR	GLO-PLUGS, CUMMINS
	192	16	LAMP, WARNING(PUSHER AXLE)	SENSOR, NEWAY
	193	14	CIRCUIT BREAKER, 10 AMP	SWITCH, ELECT TILT PUMP
	193A	14	SWITCH, TILT PUMP	SOLENOID, COIL TERM
	193B	14	BATTERY	SOLENOID
	193C	14	SOLENOID, POINT TERM	MOTOR, TILT PUMP
A	194		SEE CIRCUIT #203	
A	194A		SEE CIRCUIT #203	
A	194B		SEE CIRCUIT #203A	
A	194C		SEE CIRCUIT #203B	
	195	14	SW, IGNITION(BATT TERM)	TIMER, ENGINE SHUTDOWN SEE CIRCUIT #178)

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CL	CIRC NO	WIRE GA	FROM	TO
	195A	14	TIMER, ENGINE SHUTDOWN	SWITCH,IGNITION(COIL TERM SEE CIRCUIT #178A)
A			**FUEL/WATER SEPARATOR HEATER**	
D,E	196	12	CIRCUIT BREAKER	RELAY
D,E	196	12	RELAY	HEATER, FUEL/WATER SEPARATOR
D,E	196A	12	SWITCH, TOGGLE	RELAY, FUEL HEATER(COIL TERM, AND/OR WARNING LAMP)
E	196B	12	SW, IGNITION(ACC TERM)	CIRCUIT BREAKER
A,E	196B	12	CIRCUIT BREAKER	SWITCH, TOGGLE(FUEL HEATER)
C	196C	6	BATTERY	CIRCUIT BREAKER, 60 AMP
C	196C	6	CIRCUIT BREAKER, 60 AMP	RELAY, HEAVY DUTY
C	196C	6	RELAY, HEAVY DUTY	HEATER, FUEL
E	196E	10	CIRCUIT BREAKER, 30 AMP	MODULE, TIMER(FUEL HEATER)
E	196F	10	MODULE,TIMER(FUEL HEATER)	SWITCH, TOGGLE(FUEL HEATER)
E	196G	10	SWITCH,TOGGLE(FUEL HEATER)	MODULE, TIMER(FUEL HEATER)
E	196H	10	MODULE,TIMER(FUEL HEATER)	HEATER, ELEMENT(FUEL)
E	196J	10	MODULE,TIMER(FUEL HEATER)	LAMP, INDICATOR
E	196K	10	CIRCUIT BREAKER	RELAY
E	196L	10	SWITCH, FUEL HEATER	RELAY,COIL TERM&IND.LAMP
E	196M	10	RELAY	HEATER, FUEL
E	196N	10	RELAY	HEATER, FUEL
F	196P	10	RELAY, FUEL HEATER	SWITCH, TEMP, FUEL HTR
	197	14	LAMP, WARNING(LOCKUP)	SWITCH, PRESSURE(HT 750 AUTO TRANSMISSION)
	198	14	CIRCUIT BREAKER, 10 AMP	SWITCH,PRESSURE(2 SP AXLE)
	198	14	SWITCH, PRESSURE(2 SPEED AXLE)	ACTUATOR,SPEEDO DRIVE JOINT
	200	14	SWITCH, PTO	LAMP, #1 WARNING(PTO)
	200A	14	SWITCH, PTO	LAMP, #2 WARNING(PTO)
	200B	14	SWITCH, PTO	LAMP, #3 WARNING(PTO)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
	200C	14	SWITCH, PTO	LAMP, #4 WARNING(PTO)
D	200D	14	CIRCUIT BREAKER, 10 AMP	SWITCH, DASH
D	200E	14	SWITCH, DASH	SOLENOID,TRANSMISSION MTD
D	200F	14	SWITCH, BACKUP LAMP	SWITCH, PRESSURE(PTO)
	201	6	BATTERY	SPLICE, CIRCUIT #14
	202	6	ALTERNATOR, 30 SI TR(OUTPUT)	STARTER, 24V(BATT TERM)
E	202		TR OUTPUT(24V START)	
A			**WILLIAMS EXHAUST BRAKE**	
A	203	14	SWITCH, IGNITION	FUSE, 3 AMP
A	203	14	FUSE, 3 AMP	SWITCH, DASH CONTROL
J	203A	14	SWITCH/RELAY, EXH.BRAKE.	SOLENOID SUPPLY,EXH.BRAKE
J	203B	14	SWITCH, THROTTLE	SOLENOID, RETURN, EXHAUST BRAKE
	203C	14	RELAY,EXHAUST BRAKE CUT-OUT	SWITCH, CRUISE CONTROL ON-OFF
	203C	14	SW,CRUISE CONTROL ON-OFF	GROUND
B	203D	14	SW, PRESS(EXHAUST BRAKE)	LAMP, INDICATOR
K	203E	16	SOLENOID VALVE POWER EXHAUST BRAKE WARMUP	SWITCH/STARTER SIGNAL
C	204	16	CIRCUIT BREAKER	LAMP, WARNING(SEAT BELT) & ALARM, BUZZER(SEAT BELT)
	204A	16	LAMP & ALARM(WARNING)	SWITCH, SEAT BELT
J	205	14	RELAY,HDLT WARNING	ALARM,HDLT ON WARNING
	205A	14	SWITCH, TRINARY	SOLENOID, AIR FAN VALVE
E	205A		TRINARY SWITCH	FAN CLUTCH SOLENOID FEED
	206	16	RELAY, POWER(COIL TERM)	SWITCH, LOW OIL PRESSURE
	206	16	SWITCH, LOW OIL PRESSURE	SWITCH,IGNITION(COIL TERM)
A	206A	16	RELAY, POWER(POWER OUT)	RELAY,HEATER-A/C(COIL TERM)

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CL	CIRC NO	WIRE GA	FROM	TO
	207	14	CIRCUIT BREAKER	HEATER, AIR DRYER(SEE CIR. #94)
	208	14	SWITCH, IGNITION	SOLENOID, TRI-AXLE SUSPENSION(NEWAY WITH PUSHER)
F	209	16	CIR BRKR, IGN CONTR'D	SWITCH, PRESSURE
F	209	16	SWITCH, PRESSURE(2 SPD AXLE)	SOLENOID, ADAPTER (EATON 2 SPD DIFFERENTIAL)
F	209A	16	SWITCH, PRESSURE(2 SPD AXLE)	GAUGE,SPEEDOMETER(AUX TERM)
	210	14	SWITCH, SOLENOID(CAB POWER)	CIRCUIT BREAKER
	210	14	CIRCUIT BREAKER	SWITCH
	210	14	SWITCH	SOLENOID, COIL TERM
	211	14	CIRCUIT BREAKER	SWITCH, KEY(BURGLAR ALARM,SEE CIRCUIT #185)
	211A	14	SWITCH, KEY	MODULE,SIREN(SEE CIR#185A)
	211B	14	SWITCH, DOOR	MODULE,SIREN(SEE CIR#185B,C)
	212	14	CIRCUIT BREAKER	SWITCH, REFRIGERATOR
	212A	14	SWITCH	REFRIGERATOR
	213	12	CONVERTER, 110V TO 12V	CIRCUIT BRKR, 30 AMP(12V)
	213A	14	CHARGER, 12V CONVERTER	BATTERY, 12V(POS TERM)
	213B	12	CONVERTER, 110V(12V OUTPUT)	CIRCUIT BREAKER, AUX
	214	14	GENERATOR, AUX(SUPPLY VOLTAGE)	
			WEBASTO HEATER	
	215	12	BATTERY, 12V(POS TERM)	CIRCUIT BREAKER, 10 AMP
	215A	12	CIRCUIT BREAKER, 10 AMP	MODULE,HTR CONTROL(TERM#4)
	215B	14	MODULE, HTR CONTROL(TERM #6)	LAMP, HEATER

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CL	CIRC NO	WIRE GA	FROM	TO
	215C	14	LAMP, HEATER	MODULE,HTR CONTROL(TERM#3)
	215D	14	MODULE,HTR CONTRL(TERM #1)	SWITCH, HEATER ON–OFF
	215D	14	SWITCH, HEATER ON–OFF	CIR BRKR,10 AMP(AT BUS BAR)
	215E	12	PLUG, HTR CONTROL(TERM #1)	PUMP
	215F	12	PLUG, HTR CONTROL(TERM #2)	PUMP
	215G	12	PLUG, HTR CONTROL(TERM #2)	SOLENOID, FUEL SHUTOFF
	215H	12	PLUG, HTR CONTROL(TERM #5)	SOLENOID, FUEL SHUTOFF
	215J	14	NOZZLE, PREHEAT	UNIT, HEATER CONTROL
	215J	14	UNIT, HEATER CONTROL	GROUND
B	215M	14	FUSE, 15 AMP	CONNECTOR, CAB/CHASSIS
B	215M	8	CONNECTOR, CAB/CHASSIS	RELAY, HEATER
J	215N	14/16	SWITCH	WABASTO HTR MODULE
J	215P	14/16	TIMER CONTROL	WABASTO HTR MODULE
			STERLING ENGINE IDLER	
	216	16	SWITCH, IGNITION	SWITCH,AIR(SPRING BRAKES)
	216A	16	SWITCH, AIR(SPRING BRAKES)	SWITCH, CONSTANT AIR
	216B	16	SWITCH, CONSTANT AIR	CYCLER, ENGINE(+ TERM)
	216C	16	CYCLER, ENGINE	SWITCH,SOLENOID(+CIRCUIT)
	216D	14	CYCLER, ENGINE	SWITCH, HOOD TILT
	216E	14	SWITCH, HOOD TILT	CYCLER, ENGINE(SOLENOID WIRE)
	217	10	SWITCH, SOLENOID	CIRCUIT BREAKER, 30 AMP
	217C	10	SWITCH, SOLENOID	SOLENOID, SYNCHRO START
	218	16	SWITCH, IGNITION	GAUGE, DIGITAL PYROMETER
	219	16	GAUGE, TURBO PRESSURE	SENSOR, TURBO PRESSURE
E	220	12	SWITCH, IGNITION(ACC TERM)	RELAY, ACCESSORY

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CL	CIRC NO	WIRE GA	FROM	TO
	221	14	CIRCUIT BREAKER	SWITCH, TOGGLE(AIR SUSP DUMP)
	221A	14	SWITCH, TOGGLE	SOLENOID, VALVE(AIR SUSP DUMP)
B	222	16	RELAY, LH HEADLAMP(TERM #86)	SWITCH, DIMMER
B	222	16	RELAY, RH HEADLAMP(TERM #86)	SWITCH, DIMMER
E	222		HEADLAMP DIMMER SW FEED	
			TRANSMISSION SHIFT CONTROL	
	223	16	LAMP, INDICATOR	CONTROL, TRANSMISSION SHIFT
E			**AUTO TRANSMISSION SHIFT CONTROLS**	
E	223A	14	CIRCUIT BREAKER, IGN CONTR'D	RELAY,AUTO TRANS MODULATOR
E	223B	14	RELAY, AUTO TRANS MODULATOR	SOLENOID, VALVE
L	223C	16	IGN FUSE/BRKR	TRANSLATOR MODULE,IGN PWR
C	223H	16	CONTROL, TRANS SHIFT	SOLENOID, SHIFT CONTROL
L	223H	16	TRNSLTR MODULE/ENG OUTPUT	MODULATOR RELAY SIG
	224	16	CONTROL, TRANS SHIFT	LAMPS, REAR INDICATOR
	225	16	GAUGE, DIGITAL(PRIMARY AIR)	SENSOR, PRIMARY AIR
	226	16	GAUGE, DIGITAL(SECONDARY AIR)	SENSOR, SECONDARY AIR
	227	16	GAUGE, DIGITAL(APPL'TION AIR)	SENSOR, APPLICATION AIR
	228	16	GAUGE, DIGITAL(OIL PRES)	SENSOR, OIL PRESSURE
			TLM RETARDER	
	229	14	UNIT, HAND LEVER(TERM C)	RELAY, BOX(TERM E)
	229A	14	UNIT, HAND LEVER(TERM #4)	RELAY, BOX(TERM #4)
	229B	14	UNIT, HAND LEVER(TERM #3)	RELAY, BOX(TERM #3)

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CL	CIRC NO	WIRE GA	FROM	TO
	229C	14	UNIT, HAND LEVER(TERM #2)	RELAY, BOX(TERM #2)
	229D	14	UNIT, HAND LEVER(TERM #1)	RELAY, BOX(TERM #1)
	229E	14	UNIT, HAND LEVER(TERM #1)	LAMP, INDICATOR
C	230	00	STARTER, 12V(BATT TERM)	RELAY, BOX(+ TERM)
	230A	2-#6	RELAY, BOX(TERM #1)	RETARDER
	230B	2-#6	RELAY, BOX(TERM #2)	RETARDER
	230C	2-#6	RELAY, BOX(TERM #3)	RETARDER
	230D	2-#6	RELAY, BOX(TERM #4)	RETARDER
	230E	14	RELAY, BOX(TERM S)	SWITCH, STOPLIGHT(TERM W/36A)
	231	14	SPLICE, INTO CIRCUIT #25	RELAY, CAB TILT ALARM
			TRANSMISSION INDEXING	
	232	14	TRANSMISSION, ORANGE WIRE	SOURCE, 12V(2 AMP INLINE FUSE)
	232A	14	TRANSMISSION, GREEN WIRE	GROUND
	233A	14	SWITCH, IGNITION	RETARDER, TELEFLEX(ALLISON AUTO TRANSMISSION)
	233B	14	RETARDER	LAMP, INDICATOR
E	233C	14	CONTROL, RETARDER OUTPUT	SOLENOID, VALVE
	234	14	CIRCUIT BREAKER, IGN CONTR'D	SENSOR, THERMOSTAT(FAN CLUTCH)
E	234		FAN CLUTCH THERMOSTAT CONTROL FEED	
	234A	14	SENSOR, THERMOSTAT	SOLENOID, FAN CLUTCH
E	234A		FAN CLUTCH SOLENOID FEED	
	234B	14	SOLENOID, FAN CLUTCH	SENSOR,MULTISTAT
	234C	14	SWITCH, MANUAL OVERRIDE	SENSOR,MULTISTAT(GND TERM)
	234D	14	SOLENOID, SHUTTER OVERRIDE	SENSOR,MULTISTAT(MAN OVERRIDE)
	234E	14	CIRC BRKR, 10 AMP(IGN CONTR'D)	SENSOR,SHUTTER THERMOSTAT
	234E	14	SENSOR, SHUTTER THERMOSTAT	SOLENOID, SHUTTER
H	234F	14	OVRD SW SUPPLY, ENG FAN	CIR BRKR, IGN
J	234G	16	SWITCH,FAN OVERRIDE	LIGHT,INDICATOR,ENG.FAN

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CL	CIRC NO	WIRE GA	FROM	TO
			LENMAR OVERSPEED CONTROL	
B	235	14	SWITCH, IGNITION(COIL TERM)	SWITCH, FUEL VALVE PRESSURE (GREEN & BLACK WIRE)
B	235A	14	SWITCH, IGNITION(BATT TERM)	SOLENOID, VALVE(WHITE WIRE)
B	235B	14	SWITCH, PUSHBUTTON VERIFY	SOLENOID, VALVE(RED WIRE)
B	235C	14	SWITCH, ELECTRONIC SPEED	SWITCH,PUSHBUTTON VERIFY (GROUND, BLACK WIRE)
B	235D	14	SWITCH, ELECTRONIC SPEED	SWITCH,PUSHBUTTON VERIFY (RED WIRE)
B	235E	14	SENDING UNIT, PULSE GEN	SWITCH, ELECTRONIC SPEED
B	235F	14	SENDING UNIT, PULSE GEN	SWITCH, ELECTRONIC SPEED
	236	14	LAMP, WARNING(NEUTRAL POSITION)	SWITCH, AUX TRANSMISSION (FULLER AT1202)
	237	16	SWITCH, IGNITION	SWITCH, DASH CONTROL
	237	16	SWITCH, DASH CONTROL	RELAY,PWR(ROCKWELL AUTO INTERAXLE LOCK SYSTEM)
	238	14	SWITCH, IGNITION	SWITCH, DASH CONTROL
	238	14	SWITCH, DASH CONTROL	SOLENOID,PTO VALVE(CHELSEA PRODUCTS, DIV OF DANA)
	239	14	CIRCUIT BREAKER, 10 AMP	RELAY, POWER(TERM E, ROCKWELL AUTO INTERAXLE LOCK SYSTEM
	240	14	INDICATOR, WATER WATCHER	PROBE,FUEL-WATER SEPARATOR BOWL(CHICAGO RAWHIDE)
	240A	14	INDICATOR, WATER WATCHER (GROUND TERMINAL)	PROBE, FUEL-WATER SEPARATOR BOWL
	240B	14	INDICATOR, WATER WATCHER	CIRCUIT BREAKER, 20 AMP
H	240C	16	IND LT, WTR IN FUEL	MODULE, CONTROL
J	240D	14/16	MODULE,WTR-IN-FUEL	WTR-IN-FUEL SIGNAL, RELAY
			SAFEWAY OF CANADA	
	241	14	LAMP, WARNING(LOW WATER PRESS)	SWITCH, LOW WATER PRESSURE
	241A	14	GRAPH, SANGAMO TACHO	SWITCH, LOW WATER PRESSURE

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CL	CIRC NO	WIRE GA	FROM	TO
	241B	14	GRAPH, SANGAMO TACHO	SWITCH, LOW OIL PRESS(25 PSI, SAFEWAY OVERSPEED SYS)
	242	14	CIRCUIT BREAKER	SWITCH, ON-OFF(SEAT MASSAGE)
	243	12	CIRCUIT BREAKER	RELAY
	243	12	RELAY	INVERTER
	243	12	INVERTER	OVEN, MICROWAVE
D	244	16	CIRC BRKR, 10 AMP(IGN CONTR'D)	MODULE, HEWITT SPEED ALARM
B	244A	14	MODULE, CONTROL(RED WIRE)	SENSOR, SPEED
B	244B	14	MODULE, CONTROL(YELLOW WIRE)	SENSOR, SPEED
B	244C	14	MODULE, CONTROL(BROWN WIRE)	VALVE, FUEL CONTROL
b	244D	14	ALARM, SPEED(GREEN WIRE)	SOLENOID, SHUTDOWN(CAT ONLY)
	245	16	RELAY, BOX(TERM A)	SWITCH, PRESSURE(PNC/A22)
	245A	16	SWITCH, PRESSURE(PNC/A22)	ALARM, BUZZER(PNC/P3)
	245B	16	SWITCH, IGNITION(COIL TERM)	RELAY, BOX(PNC/533, TERM B)
			JERRY STUGART P&N COMPANY	
	246	14	SW, AUX HEATER OR POWER	PUMP, ELECTRIC FUEL
E	246	14	CIR BRKR,IGN CONTR'D	SWITCH, ELECT FUEL PUMP
E	246A	14	SWITCH, ELECT FUEL PUMP	PUMP, ELECTRIC FUEL
E	246A	14	SWITCH, ELECT FUEL PUMP	LAMP, INDICATOR(FUEL PUMP)
	247	14	LAMP, INDICATOR	SWITCH, MVT AIR PRESSURE
	247A	16	RELAY, CONTACT TERM	LAMP, INDICATOR
	247B	14	RELAY, COIL TERM	SWITCH,EXTRA LO AIR PRESSURE
			ULANET WATCHDOG ENGINE SHUTDOWN	
B	248	14	SWITCH, IGNITION	MODULE, WATCHDOG
B	248A	14	MODULE, WATCHDOG	SENDING UNITS

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CL	CIRC NO	WIRE GA	FROM	TO
B	248B	14	MODULE, WATCHDOG	SOLENOID, SHUTDOWN
E	248C	14	MODULE,OVERRIDE(BLACK WIRE)	SWITCH, OVERRIDE
	248C	16	SWITCH, OVERRIDE	WIRE, BLACK
	248C	16	WIRE, BLACK	MODULE
	248D	16	MODULE, YELLOW WIRE	LAMP, WARNING
	248D	16	LAMP, WARNING	MODULE
			WEBB CONTINUOUS OIL CHANGE	
F	249	16	CIRCBRKR,10 AMP(IGN CONT'D)	MODULE, TIMER(WHITE WIRE)
F	249	16	CIRCBRKR,10 AMP(IGN CONT'D)	SOLENOID, OIL CHANGER
F	249A	16	CIRCBRKR,10 AMP(IGN CONT'D)	MODULE, TIMER(RED WIRE)
F	249B	16	MODULE,TIMER(YELLOW WIRE)	SOLENOID, OIL CHANGER
			BW CRUISE CONTROL	
D,E	250	16	CIRCUIT BREAKER	SWITCH, ON–OFF
D,E	250	16	CIRCUIT BREAKER	SWITCH, SET–RESUME
D	250A	16	SWITCH, ON–OFF	LAMP, INDICATOR
D	250B	16	SWITCH, ON–OFF	MODULE, WHITE/GREEN WIRE
D	250C	16	SWITCH, SET–RESUME	MODULE, WHITE/RED WIRE
D	250D	16	SWITCH, SET–RESUME	MODULE, WHITE/YELLOW WIRE
D	250E	12	SWITCH, BRAKE	MODULE, ORANGE WIRE
D	250F	16	SWITCH, CLUTCH	MODULE, BLUE WIRE
D	250F	16	MODULE, VIOLET WIRE	SWITCH, CLUTCH
D	250G	16	SPEEDOMETER, + SIG	MODULE, GRAY WIRE
D	250G	16	SENSOR, MPH(+ SIG)	MODULE, GRAY WIRE
D,E	250H	16	SPEEDOMETER, – SIG	MODULE, GROUND
D,E	250H	16	SENSOR, MPH(– SIG)	MODULE, GROUND
D	250J	16	MODULE, BLACK WIRE	ACTUATOR,THRTTL(BLACK WIRE)
D	250K	16	MODULE, WHITE WIRE	ACTUATOR,THRTTL(WHITE WIRE)
D	250L	16	MODULE, RED WIRE	ACTUATOR,THRTTL(RED WIRE)
E	250M	16	MODULE, YELLOW WIRE	SOLENOID, SUPPLY AIR

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CL	CIRC NO	WIRE GA	FROM	TO
E	250N	16	MODULE, BROWN/YELLOW WIRE	SOLENOID, EXHAUST AIR
E	250P	16	MODULE, YELLOW/GREEN WIRE	SOLENOID,SUPPLY AIR
E	250Q	16	MODULE, BROWN WIRE	SOLENOID, EXHAUST AIR
C			**CRUISE CONTROL WITH CAT BRAKESAVER**	
B	250T	16	MODULE, GREEN WIRE	SWITCH, HANDVALVE PRESSURE
B	250T	16	SWITCH, HANDVALVE PRESSURE	GROUND
			CUMMINS ARREST SYSTEM	
B	251	14	CIRCUIT BREAKER	SWITCH, OVERSPEED(C TERM)
B	251A	14	SWITCH, OVERSPEED(C TERM)	SWITCH, TEST
B	251A	14	SWITCH, TEST	SWITCH, OVERSPEED(NO TERM)
B	251B	14	SWITCH, OVERSPEED(NO TERM)	SOLENOID, ENGINE SHUTDOWN
E	251C	14	SENSOR, MPH(+ SIG)	SWITCH, OVERSPEED
E	251D	14	SENSOR, MPH(- SIG)	SWITCH, OVERSPEED
E	251E	14	SWITCH, TEST	CIRCUIT BREAKER
E	251F	14	SWITCH, TEST	SOLENOID, ENGINE SHUTDOWN
E	251G	14	SOLENOID, ENGINE SHUTDOWN	RELAY
E	251H	14	RELAY	SWITCH, OVERSPEED
E	251J	14	RELAY	CIRCUIT BREAKER
F	251K	14	SWITCH, MANUAL SHUTDOWN	SWITCH, OVERSPEED
F	251L	14	VALVE, SOLENOID	SWITCH, OVERSPEED
F	251M	14	VALVE, SOLENOID	SWITCH, OVERSPEED
			LENMAR ENGINE SHUTDOWN	
B	252	14	LAMP, WARNING & ALARM	SWITCH, OIL PRESSURE
B	252A	14	SWITCH, IGNITION(COIL TERM)	BUTTON, OVERRIDE
B	252B	14	BUTTON, OVERRIDE	SOLENOID, FUEL BYPASS
B	252C	14	BUTTON, START	SOLENOID, FUEL BYPASS

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CL	CIRC NO	WIRE GA	FROM	TO
B	253	14	SWITCH, IGNITION	LAMP, WARNING(CAB TILT)
B	254	14	CIRCUIT BREAKER	SWITCH, ON–OFF
B	254	14	SWITCH, ON–OFF	LIGHT, REVOLVING EMERGENCY
B	254A	14	SWITCH, ON–OFF	LAMP, WARNING(REV EMERG. LIGHT)
E			**FIRE TRUCK ROTATING ROOF LAMPS**	
E	254	10	CIRCUIT BREAKER, 30 AMP	SWITCH, ROTATORS
E	254A	10	SWITCH, ROTATORS	LAMP, PANEL INDICATOR
E	254B	10	SWITCH, ROTATORS	WIRE, COILED IN ROOF
E	254C	10	SWITCH, ROTATORS	JUNCTION BOX, 7–TERM
	255	14	CIRCUIT BREAKER	SWITCH
	255	14	SWITCH	LIGHT, ADVERTISING
	255A	16	SWITCH	LAMP, INDICATOR(AD LIGHT)
	256	14	SOURCE, 12V	WIRE, END OF FRAME
	257	16	CIRCUIT BREAKER	CONTROL, DELAYED WIPER
	257A	16	CONTROL, DELAYED WIPER (+ WHITE WIRE)	SOLENOID, RH CONTROL
	257B	16	CONTROL DELAYED WIPER (+ WHITE WIRE)	SOLENOID, LH CONTROL
	257C	16	CONTROL DELAYED WIPER (– WHITE WIRE)	SOLENOID, RH CONTROL
	257D	16	CONTROL, DELAYED WIPER (– WHITE WIRE)	SOLENOID, LH CONTROL
	258	18	SWITCH, HYDRAULIC FIFTH WHEEL	LAMP, WARNING(NC POSITION)
	258A	18	SWITCH, HYDRAULIC FIFTH WHEEL	LAMP, WARNING(NO POSITION)
	259	6	ALTERNATOR, OUTPUT TERM	CONTROL, DUVAC(TERM #1)
E	259A	14	ALTERNATOR, OUTPUT TERM	SHUNT, AMMETER(BATTERY SIDE)
	260	16	SOURCE,MURPHY SHTDWN PWR	SWITCH, MAG

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CL	CIRC NO	WIRE GA	FROM	TO
	260A	16	SWITCH, MAG	SOLENOID, ENGINE SHUTDOWN
	261	16	SW, CONTR'D DIFF LOCKOUT	LAMP, INDICATOR
			ALLISON AUTOMATIC RETARDER	
E	262	14	CIR BRKR, IGN CONTR'D	SOLENOID, VALVE(RETARDER)
	262A	14	CIRCUIT BREAKER	SWITCH, TOGGLE
	262B	14	SWITCH, TOGGLE	SWITCH, THROTTLE(DDE BUFFER)
	262C	14	SW, THROTTLE(DDE BUFFER)	LAMP, INDICATOR
E	262D	14	SW, THROTTLE(OUTPUT) OR	SOLENOID, VALVE(RETARDER)
E	262D	14	RELAY, OUTPUT	SOLENOID, VALVE(RETARDER)
	262E	14	SOLENOID, VALVE(CAT & CUM)	SWITCH, PRESSURE
E	262F	14	SWITCH, HIGH TEMP (RETARDER OUTPUT)	LAMP, WARNING (RETARDER OVERHEAT)
E	262G	14	SWITCH, PRESSURE (RETARDER OUTPUT)	LAMP, INDICATOR (RETARDER ON)
			STERLING TECHNOLOGIES SHUTDOWN	
B	263	14	SW, IGNITION(COIL TERM)	MODULE, POWER WIRE(TERM #1)
B	263A	14	MODULE, TERM #4	SENSOR, LOW OIL LEVEL
B	263B	14	MODULE, TERM #3	SENSOR, LOW OIL PRESSURE
B	263C	14	MODULE, TERM #2	SOLENOID, RUN(ENGINE)
B	263D	14	MODULE, TERM #5	SENSOR, HIGH WATER TEMP
B	263E	14	MODULE, TERM #6	PROBE, LOW WATER LEVEL
B	263F	14	MODULE, TERM #8	BUTTON, TEST(ENGINE SHUTDOWN)
B	263G	14	MODULE, TERM #9	GROUND
B	263H	14	SENSOR, OIL LEVEL	LAMP, WARNING
B	264	14	CIRCUIT BREAKER, 10 AMP	MODULE,WEBB LO WATER ALARM
			WEBB OIL MONITOR	
B	265	14	CIRCUIT BREAKER	LAMP, WARNING
B	265A	14	LAMP, WARNING	PROBE, #1

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CL	CIRC NO	WIRE GA	FROM	TO
B	265B	14	LAMP, WARNING	PROBE, #2
	265C	14	LAMP, WARNING	PROBE, #3
B	266	14	CIRCUIT BREAKER, IGN CONTR'D	LAMP, WARNING
B	266	14	LAMP, WARNING	SWITCH, PTO TRANSFER CASE
B	266	14	SWITCH, PTO TRANSFER CASE	GROUND
B	268	14	MODULE, CONTROL(TERM S, MURPHY GAUGE SWITCH)	ALARM
B	268A	14	ALARM, MURPHY GAUGE SWITCH	CIRCUIT BREAKER
B			**ENGLER ELECTRONIC SPEEDO & TACH**	
B	269	14	GENERATOR, PULSE(RED WIRE)	GAUGE, SPEEDO(RED WIRE)
B	269A	14	GENERATOR, PULSE(BLACK WIRE)	GAUGE, SPEEDO(BLACK WIRE)
B	269B	14	GENERATOR,PULSE(GREEN WIRE)	GAUGE, SPEEDO(GREEN WIRE)
B	270	14	GENERATOR, PULSE(RED WIRE)	GAUGE, TACH(RED WIRE)
B	270A	14	GENERATOR,PULSE(BLACK WIRE)	GAUGE, TACH(BLACK WIRE)
B	270B	14	GENERATOR,PULSE(GREEN WIRE)	GAUGE, TACH(GREEN WIRE)
B	271	14	GAUGE,ELECTRON(OIL PRESS,GREEN WIRE)	SENDING UNIT , ELECTRONIC (OIL PRESS, GREEN WIRE)
B	272	14	CIRCUIT BREAKER	SWITCH, PRESS(DEEP REDUCTION)
B	272	14	SW, PRESS(DEEP REDUCTION)	LAMP, INDICATOR
	273	14	CIRCUIT BREAKER	LAMP, WARNING
	273	14	LAMP, WARNING	SWITCH, HIGH TEMP(REAR AXLE)
	274	14	CIRCUIT BREAKER	LAMP, WARNING
	274	14	LAMP, WARNING	SWITCH, HIGH TEMP(TRANS)

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CL	CIRC NO	WIRE GA	FROM	TO
			TRW ETEC	
	275	14	CIRCUIT BREAKER, 10 AMP	RELAY, POWER SIDE
B	275A	14	CIRC BRKR,10 AMP(POWER IN)	RELAY, COIL SIDE
			WEBB NEVER LO OIL FILL	
B	276	14	CIR BRKR,IGN CONTR'D	MODULE, CONTROL
B	276	14	MODULE, CONTROL	SOLENOID, OIL FILL
B	276A	14	SOLENOID, OIL FILL	MODULE, CONTROL
B	276B	14	SENSOR, OIL FILL	MODULE, CONTROL
B	276C	14	SENSOR,LO OIL LEVEL WRNG	MODULE, CONTROL
B	276D	14	MODULE, CONTROL	ALARM
B	276D	14	MODULE, CONTROL	GROUND
B	276E	14	MODULE, CONTROL	ALARM,LO OIL LEVEL WARNING
B	276F	14	MODULE, CONTROL	LAMP, ADD OIL WARNING
B	276G	14	SOURCE, +12 VOLTS	SWITCH, MOMENTARY
B	276H	14	SWITCH, MOMENTARY	SOLENOID
B	276H	14	SOLENOID	GROUND
			KYSOR IDLESTOP SYSTEM	
	277	16	MODULE, IDLESTOP(LOAD TERM)	RELAY, COIL TERM
E	277A	12	SWITCH, IGNITION(COIL TERM)	MODULE, IDLESTOP(POS TERM)
E	277B	12	MODULE, IDLESTOP(SENSOR TERM)	SWITCH OR RELAY,PARK BRAKE OR TRANS NEUTRAL
E	277C	12	MODULE, IDLESTOP(POS TERM)	SWITCH OR RELAY, PARK BRAKE OR TRANS NEUTRAL
	277D	16	MODULE, IDLESTOP(BATT TERM)	SWITCH, PUSHBUTTON(NC TERM)
	277E	16	SWITCH, PUSHBUTTON(NC TERM)	SWITCH, IGNITION(BATT TERM)
E	277F	14	SWITCH, PARK BRAKE OR NEUTRAL	RELAY
E			**SWF OR BOSCH WIPER MOTORS**	
	278	14	CIRCUIT BREAKER	CONTROL, RH WIPER MOTOR
	278A	14	CONTROL, RH WIPER MOTOR	MOTOR,RH WIPER(PARK TERM)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
	278B	14	CONTROL, RH WIPER MOTOR	MOTOR,RH WIPER(LO SPD TERM)
	278C	14	CONTROL, RH WIPER MOTOR	MOTOR,RH WIPER(HI SPD TERM)
	279	14	CIRCUIT BREAKER	CONTROL, LH WIPER MOTOR
	279A	14	CONTROL, LH WIPER MOTOR	MOTOR, LH WIPER(PARK TERM)
	279B	14	CONTROL, LH WIPER MOTOR	MOTOR, LH WIPER(LO SPEED TERM)
	279C	14	CONTROL, LH WIPER MOTOR	MOTOR, LH WIPER(HI SPEED TERM)
F	279D	12	CIRC BRKR, 15A(ELEC MOTOR)	RELAY, ELEC WIPER(TERM #30)
F	279E	14	CIRC BRKR, 10A(IGN CONTR'D)	RELAY, ELEC WIPER(TERM #85)
			HEWITT PYROMETER ALARM	
	280	14	CIRCUIT BREAKER	MODULE, ALARM(BLACK WIRE)
	280A	14	MODULE, ALARM(BROWN WIRE)	GAUGE, PYROMETER(NEG TERM)
	280B	14	MODULE, ALARM(GREEN WIRE)	GAUGE, PYROMETER(POS TERM)
	280C	14	MODULE, ALARM(BLUE WIRE)	GAUGE, PYROMETER(POS TERM, OPPOSITE SIDE OF CIRC #280B)
	280D	14	MODULE, ALARM(ORANGE WIRE)	GAUGE, PYROMETER(NEG TERM, OPPOSITE SIDE OF CIRC #280A)
	280E	14	MODULE, ALARM(YELLOW WIRE)	SOLENOID, SHUTDOWN ACTUATOR
E	280F	16	MODULE, ALARM(BROWN WIRE)	DIODE, BUZZER
			OIL FILTER CHANGE WARNING LAMP(FULL FLOW OIL FILTER)	
	281	14	CIRCUIT BREAKER	SWITCH, OIL FILTER SENSOR
	281	14	SWITCH, OIL FILTER SENSOR	LAMP, WARNING(FILTER CHANGE) ISSPRO ENGINE SHUTDOWN
	282	16	MODULE, CONTROL(WHITE WIRE)	GAUGES, BAR ALARM
	282A	16	RELAY, SHUTDOWN(NO TERM)	SOLENOID, ENGINE SHUTDOWN
			WEBB HIGH IDLE CYCLER	
B	283	14	CIRCUIT BREAKER, IGN CONTR'D	SWITCH, TILT
B	283A	14	MODULE, RED WIRE	SOLENOID
E	283A	14	SWITCH, SPRINGBRAKE	MODULE, RED WIRE(+ TERM)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
B	283B	14	MODULE, BLUE WIRE	SOLENOID
E	283C	14	SWITCH, TILT	SWITCH, SPRINGBRAKE
			BIG CAM III OIL FILTER WARNING	
B	284	14	CIRCUIT BREAKER, IGN CONTR'D	LAMP,WARNING(RESTR FILTER)
B	284	14	LAMP, WARNING(RESTR FILTER)	SWITCH, RESTRICTED OIL FILTER
B	284	14	SWITCH, RESTRICTED OIL FILTER	GROUND
B	285	14	CIRCUIT BREAKER	SWITCH,AIR SUSP. PRESS
L	285	16	SWITCH,SUSPENSION	WARN LT SIG,SUSP
E	285A	14	SWITCH, AIR SUSP PRESS	CONNECTOR, CAB/CHASSIS
E	285A	16	CONNECTOR, CAB/CHASSIS	LAMP, WARNING(AIR SUSP.)
L	285A	16	IGN FUSE/BRKR	SWITCH SPLY,SUSP
E	285B	14	SWITCH, AIR SUSPENSION PRESS	CONNECTOR, CAB/CHASSIS
E	285B	16	CONNECTOR, CAB/CHASSIS	WARNING, BUZZER(AIR SUSP)
F	285C	14	SWITCH, PRESS(AXLE LIFT)	LIGHTBAR, PIN #C13
			RAYCO FUEL WATER SEPARATOR	
	286	14	SENSOR, WATER BOX(GREEN WIRE)	BOWL, FUEL WATER SEPARATOR
			SANGAMO ELECTRONIC TACH	
	287	14	CIRCUIT BREAKER	SWITCH, OIL PRESSURE
	287	14	SWITCH, OIL PRESSURE	WIRE, WHITE/GRAY(SANGAMO TACH HARNESS)
			STERLING ALARM SYSTEM	
	288	14	MODULE, YELLOW WIRE	SWITCH, LOW OIL PRESSURE
	288A	14	SWITCH, LOW OIL PRESSURE	LAMP, WARNING(LO OIL PRESS)
	288B	14	MODULE, GREEN WIRE	SWITCH, HIGH WATER TEMP
	288C	14	SWITCH, HIGH WATER TEMP	LAMP, WARNING(HI WATER TEMP)
			FULLER TRANSMISSION	

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
	289	14	CIRCUIT BREAKER	SWITCH, TRANSMISSION
	289	14	SWITCH, TRANSMISSION	LAMP, INDICATOR(NEUTRAL POS)
			HEWITT ALARM SYSTEM	
	290	14	LAMP,WRNING(LOW WATER LVL)	MODULE, CONTROL(BROWN WIRE)
	290A	14	LAMP,WRNING(LOW OIL PRESS)	SWITCH, LOW OIL PRESS
	290A	14	LAMP,WRNING(LOW OIL PRESS)	MODULE, GREEN WIRE
	290B	14	LAMP,WRNING(HI WATER TEMP)	SWITCH, HI WATER TEMP
	290B	14	LAMP,WRNING(HI WATER TEMP)	MODULE, RED WIRE
	290C	14	PROBE, LOW WATER	MODULE, YELLOW WIRE
	290D	14	LAMP,WRNING(LOW AIR PRESS)	SWITCH, LOW AIR PRESS
	290D	14	SWITCH, LOW AIR PRESS	MODULE, ORANGE WIRE
			WEBB OIL/COOLANT LEVEL MONITOR	
	291	14	CIRCUIT BREAKER, AUX	MODULE, CONTROL
E	291A	14	MODULE, CONTROL(GREEN WIRE)	PROBE, LOW WATER LEVEL
	291B	14	RELAY, COIL SIDE	PROBE, #8(OIL SENSING CHAMBER)
	291C	14	RELAY, POWER OUTPUT	LAMP, WARNING
E	291D	14	MODULE, CONTROL(BROWN WIRE)	PROBE, #2(OIL SENSING CHAMBER)
E	291E	14	MODULE, CONTROL(YELLOW WIRE)	PROBE, #4(OIL SENSING CHAMBER)
E	291F	14	MODULE, CONTROL(PURPLE WIRE)	PROBE, #3(OIL SENSING CHAMBER)
E	291G	14	MODULE, CONTROL(ORANGE WIRE)	PROBE, #1(OIL SENSING CHAMBER)
E			**FUEL TACH SYSTEM, FLOWSCAN OR ARGO**	
	292	16	CIRCUIT BREAKER, IGN CONTR'D	GAUGE, FUEL TACH
	292A	16	CIRCUIT BREAKER, IGN CONTR'D	CONNECTOR
	292A	14	CONNECTOR	METER, FUEL FLOW
	292B	16	GAUGE, FUEL TACH	CONNECTOR
	292B	14	CONNECTOR	METER, FUEL FLOW
	292C	16	GAUGE, FUEL TACH	CONNECTOR
	292C	14	CONNECTOR	SENSOR,TRANS SPEED(+ LEAD)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
	292D	16	GAUGE, FUEL TACH	CONNECTOR
	292D	14	CONNECTOR	SENSOR,TANS SPEED(– LEAD)
	292E	14	SENSOR, FUEL FLOW(WHITE WIRE)	GAUGE, BROWN WIRE
B	292F	16	CIRCUIT BREAKER, DOMELAMP	RELAY, POWER IN
B	292F	16	RELAY, POWER OUT	GAUGE, FUEL TACH(RED WIRE)
B	292G	16	CIRCUIT BREAKER, DOMELAMP	SWITCH
B	292G	16	SWITCH	RELAY, POWER OUT
B	292H	16	CIR BRKR,IGN CONTR'D	RELAY, COIL SIDE
E	292N	16	COUPLER, MPH SIG(POWER)	MONITOR, ARGO FMS(TERM#1, DC–OUT)
E	292N	16	COUPLER, MPH SIG(POWER)	JCT BLOCK, ARGO EDM(PLUG B)
E	292Q	16	SENSOR,+RPM SIG(WH WIRE)	MONITOR, ARGO FMS(TERM#2,INPUT)
E	292R	16	SENSOR,–RPM SIG(BL WIRE)	MONITOR, ARGO FMS(TERM #2,GND)
E	292S	16	SENSOR,+MPH SIG(WH WIRE)	MONITOR, ARGO FMS(TERM#1,INPUT)
E	292S	16	SENSOR,+MPH SIG(WH WIRE)	JCT BLOCK, ARGO EDM(PLUG B)
E	292T	16	SENSOR,–MPH SIG(BL WIRE)	MONITOR, ARGO FMS(TERM #2,GND)
E	292T	16	SENSOR,–MPH SIG(BL WIRE)	JCT BLOCK, ARGO EDM(PLUG B)
E	292U	16	SENSOR,FLOW(–SIG,BL WIRE)	MONITOR, ARGO FMS(TERM #3, GND)
E	292U	16	SENSOR, FLOW(–SIG,BL WIRE)	JCT BLOCK, ARGO EDM(PLUG A)
E	292W	16	SENSOR,FLOW(+SIG,WH WIRE)	MONITOR, ARGO FMS(TERM#3, INPUT)
E	292W	16	SENSOR,FLOW(+SIG,WH WIRE)	JCT BLOCK, ARGO EDM(PLUG A)
E	292X	16	SENSOR,FLOW(POWER,RED WIRE)	JCT BLOCK, ARGO EDM(PLUG A)
E	292Y	16	COUPLER, RPM SIG(RED WIRE)	MONITOR, ARGO FMS(TERM#2, DC–OUT)
H	292Z	14	FUEL TACH RESET SIG	GROUND
			LUBRISTART ETHER STARTING AID	
	293	12	SOLENOID, STARTER	SWITCH, MAG(POWER IN)
	293A	12	SWITCH, MAG(POWER OUT)	VALVE, ETHER STARTING AID
	293B	14	SWITCH, MAG(POWER IN)	SENSOR, THERMOSTAT
	293C	14	SENSOR, THERMOSTAT	SWITCH, MAG(COIL SIDE)
			SAB AIR TANK AUTO DRAIN VALVE	

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
	294	14	CIRCUIT BREAKER	RELAY, POWER IN
	294A	14	SWITCH, BRAKE(LAMP OUT)	RELAY, COIL SIDE
	294B	14	RELAY, POWER OUT	VALVE, AUTOMATIC DRAIN
E	295A	12	SWITCH, IGNITION(ACC TERM)	RADIO,IGN CONTR'D POWER IN
	295B	14	CIRCUIT BREAKER, 15 AMP	RADIO,CONSTANT POWER IN
	295C	14	CIRCUIT BREAKER, 15 AMP	RADIO,CB(POWER LEAD)
E	295D	14	CIRCUIT BREAKER, 15 AMP	PANEL,ACCESS(RADO + POST)
G	295E	14	AMPL, RADIO, RMT, PWR	CIRCUIT BREAKER, AMP
	296	16	CIRC BRKR, 10 AMP(IGN CONTR'D)	FUSE, 2 AMP
	296	16	FUSE, 2 AMP	SWITCH, DASH
	296	16	SWITCH, DASH	LAMP, WARNING
	296A	14	SWITCH, DASH	PUMP, FUEL TRANSFER
E	297A	14	CIRCUIT BREAKER	DIODE, BUZZER
E	297A	14	DIODE, BUZZER	LAMP, INDICATOR
E	297B	14	LAMP, INDICATOR	DIODE, BUZZER
E	297B	14	DIODE, BUZZER	GRAPH
			ELECTRIC FUEL PRESSURE GAUGE	
	298	14	SENDING UNIT	GAUGE, FUEL PRESSURE
F	298A	16	LIGHTBAR, PIN #C3 OR #C7	SWITCH, FUEL PRESSURE
			OUTSIDE CAB AIR TEMPERATURE	
E	299	16	PROBE, OUTSIDE AIR TEMP	CONNECTOR, CAB/CHASSIS
E	299	14	CONNECTOR, CAB/CHASSIS	GAUGE, AIR TEMP(COPPER TERM)
E	299A	16	PROBE, OUTSIDE AIR TEMP	CONNECTOR, CAB/CHASSIS
E	299A	14	CONNECTOR, CAB/CHASSIS	GAUGE, AIR TEMP(SILVER TERM)
E	299D	16	CIRCUIT BREAKER	GAUGE, OUTSIDE AIR TEMP

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
E	300		RADIO FEED	
E,F	301		ALARM SYSTEM FEED	
E	302		C.B. STUD FEED	
E	303		LOW AIR SWITCH JUMPER	
E	304		BACK–UP LAMP FEED	
	305		ACCESSORY–BREAKER FEED	
	306		IGNITION–BREAKER FEED	
K	306A	14	OPTION IGNITION-RUN POWER, FUSED	IGNITION FUSE/BRKR
	307		HEADLAMP SW FEED(HEAD)	
	308		AIR SLIDE 5TH WHL SWITCH FEED	
E,F	309		PARKING BRAKE SWITCH FEED	
L	309	16	RELAY/MODULE	PARK BRAKE SWITCH SIG
L	309A	14	PARK BRAKE SWITCH	PARK BRAKE SOL VLV PWR
L	309B	14	FUSE/BRKR/PRKBRK SW	PARK BRAKE SWITCH SPLY
L	309C	14	FUSE/BRKR	PARK BRAKE SWITCH SPLY
E	310		AXLE LOCK SWITCH FEED	
E	311		OPTION BLOCK FEED ACCESSORY	
E	312		RADIO POWER	BAT +

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
E	313		TURN SIGNAL FLASHER FEED	
E	314	12	RELAY, FLASHER(PWR TERM #87)	SWITCH, TURN SIGNAL(POWER IN)
E,F	314		TURN SIGNAL SWITCH FEED	
E	315		WIPER SWITCH FEED	
E,F	316		WIPER MOTOR, LOW SPEED	
E,F	317		WIPER MOTOR, PARK	
E,F	318		WIPER MOTOR, HIGH SPEED	
E,F	319		WIPER MOTOR PARK	BATT(B+)
E	320		WIPER	WASH MOTOR
E	321		ICC TRAILER MARKER & CLEARANCE LAMP FEED	
E	322		HEADLAMP SW FEED(PARK)	
E,F	323		ODOMETER OUTPUT	
E	324	16	LIGHTBAR, ALL(PIN C6)	SWITCH, WATER TEMP SHUTDOWN
E	324		HIGH WATER TEMPERATURE SHUTDOWN	
E	325	16	LIGHTBAR, ALL(PIN C7)	SWITCH, OIL PRESS SHUTDOWN
E	325		LOW OIL PRESSURE SHUTDOWN	
E	326	16	RELAY,FLSHER(COIL TERM #86)	LIGHTBAR, ALL(PIN D13)
E	326		TURN SIGNAL FLASHER TIMING CIRCUIT-SSI	

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
E	327		ENG SPEED(BUFFERED OUTPUT)	
E	328		ROAD SPEED(BUFFERED OUTPUT)	
E,F	329		PYROMETER TRANSDUCER POS FEED	
E,F	330		PYROMETER TRANSDUCER NEG FEED	
E,F	331		POSITIVE DATA LINK	
E,F	332		NEGATIVE DATA LINK	
E	333		AIR DRYER FEED	
E	334		DOME LAMP FEED	
E	335		COLD CONTROL JUMPER	
E	336		HEADLAMP RELAY	RELAY
E	337		ROAD LAMP SWITCH FEED	
E	338		BLOWER MOTOR SWITCH FEED	
E	339	16	CIRCUIT BREAKER, 10 AMP	LIGHTBAR, ALL(PIN D12)
E	339		LIGHTBAR FEED	BATTERY
E	340		COLD CONTROL SWITCH FEED	
E	341		MARKER LAMP	TRAILER

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
E	342		AMMETER FEED	
E	343		GLOW PLUG SW FEED	
	344		GLOW PLUG PRESS SW FEED	
E	345		GLOW PLUG SOLENOID	GLOW PLUGS
E	346		SPEAKER GND CIRCUIT	
E	347		SHUTTER	RELAY
E	348		TRINARY SWITCH	DUAL TEMP SWITCH(SHUTTERS)
E	349		SHUTTER SOLENOID	DUAL TEMP SWITCH
E	350	16	RELAY, FLASHER(PWR TERM #87)	LIGHTBAR, ALL(PIN D11)
E	350		TURN SIGNAL POWER TERMINAL	LIGHTBAR
E	351		ROAD SPEED FUEL SOLENOID	LIGHTBAR
E	352		CIRCUIT BREAKER	RELAY CONTACT(DELAYED SHUTDOWN)
E	353		LIGHTBAR	DELAY SHUTDOWN RELAY COIL
E	354		SHUTTER SOLENOID	TRANS TEMP SWITCH
E	355		FAN SWITCH	TRANS TEMP SWITCH
E	356		SPEED CONTROL POWER	

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CL	CIRC NO	WIRE GA	FROM	TO
E	357		FUEL SOLENOID SHUTDOWN DELAY FEED	
E	358		TRLR RELAY COIL FEED	
E	359	16	SWITCH, HEADLAMP(ON)	LIGHTBAR,KYSOR VIP(PIN C9)
E	359		TURN SIGNAL INDICATOR DIMMER	
E	360	16	SOLENOID, ENGINE FAN	LIGHTBAR,KYSOR VIP(PIN D3)
E	360		LIGHTBAR	ENGINE FAN POWER
E	361	16	SOLENOID, ENGINE SHUTTER	LIGHTBAR,KYSOR VIP(PIN D4)
E	361		LIGHTBAR	RADIATOR SHUTTER POWER
E	362		FUEL WATER SEPARATOR RELAY COIL POWER	
E	363		POWER WINDOW FEED	
E	364		POWER WINDOW UP	
E	365		POWER WINDOW DOWN	
E	366		NEVER USED	
E	367	16	LIGHTBAR, KYSOR VIP(PIN D2)	GAUGE,WATER TEMP("I" TERM)
E	367		LIGHTBAR	WATER TEMP GAUGE(B+)
E	368	16	GAUGE, WATER TEMP("S TERM)	LIGHTBAR,KYSOR VIP(PIN D10)
E	368		LIGHTBAR	WATER TEMP GAUGE(SIGNAL)
E	369	16	GAUGE,WATER TEMP("G"TERM)	LIGHTBAR, KYSOR VIP(PIN D9)

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CL	CIRC NO	WIRE GA	FROM	TO
E	369		LIGHTBAR	WATER TEMP GAUGE(LOAD)
E,G	370		AUX FEED(7 WAY)	
E	371		FINDER MINDER FEED	
E	372		TRAILER HEAVY DUTY POWER	
E	373	16	RELAY,FUEL SOLEN(TERM #86)	LIGHTBAR, VIGIL II & KYSOR VIP (PIN D6)
E	373		FUEL SOLENOID RELAY COIL FEED	
E	374		STARTER LOCK RELAY	
E,F	375		NEUTRAL	DAYLIGHT RUNNING LAMPS
E	376		ANTILOCK POWER, ROCKWELL	
E,G	377		ANTILOCK INDICATOR, ROCKWELL/BENDIX	
E,G	378		ANTILOCK SOLENOID, ROCKWELL/BENDIX	
F	379		PARK BRAKE INPUT	DAYLIGHT RUNNING LAMPS
G	379A		DRL PARK BRAKE SWITCH	ALTERNATING HDLT SWITCH
L	379B	16	DRL MOD.PARK BRK SW	SWITCH OUTPUT,DRL OVRRD
F	380		DAYLIGHT RUNNING LAMPS CIRCUIT BREAKER FEED	
F	381		DAYLIGHT RUNNING LAMPS	BATTERY +
F	382		LH HEADLAMP RELAY	DAYLIGHT RUNNING LAMPS

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CL	CIRC NO	WIRE GA	FROM	TO
F	383		RH HEADLAMP	DAYLIGHT RUNNING LAMPS
F	384		PROGRAMMING ENABLE	
F	385		DAYLIGHT RUNNING LAMPS CONTROL	
F	386		LOW BEAM, LH	DAYLIGHT RUNNING LAMPS
F	387		LOW BEAM, RH	DAYLIGHT RUNNING LAMPS
F	388		HYDRAULIC BRAKE POWER	
F,G	389		HYDRAULIC BRAKE BATTERY +	RELAY COIL FEED
F	390		HYDRAULIC BRAKE MODULE OUTPUT	BRAKE LAMP RELAY
F	391		HYDRAULIC BRAKE RELAY FEED	
F	392		HYDRAULIC BRAKE MOTOR PUMP FEED	
F	393		FLOW SWITCH INPUT & RELAY COIL GND	
F	394		HYDRAULIC BRAKE MODULE OUTPUT	PARK BRAKE LAMP
L	394A	16	IGN ACTVD RELAY	PARK BRAKE SW GND SPLY
F	395		HYDRAULIC BRAKE FLUID LEVEL SENSOR	
F	396		HYDRAULIC BRAKE MODULE OUTPUT	BUZZER
F	397		HYDRAULIC BRAKE DOOR OPEN SWITCH SIGNAL	

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CL	CIRC NO	WIRE GA	FROM	TO
F	398		HYDRAULIC BRAKE COIL SENSE SIGNAL	
J	399	14	CIR BRKR/FUSE,OPTIONAL	OPTION SWITCH SUPPLY
J	399A	14	SWITCH, OPTIONAL	OPTION SWITCH OUTPUT
J	400	14	CIR BRKR/FUSE,OPTIONAL	OPTION, SWITCH SUPPLY
J	400A	14	SWITCH, OPTIONAL	OPTION, SWITCH OUTPUT
B	401	14	SW, BLOCK HTR(TCS UNIT)	SWITCH, ENGINE BLOCK TEMP
B	401A	14	SWITCH, ENGINE BLOCK TEMP	TIMER, DELAY(TCS UNIT)
B	401B	14	UNIT, TCS(BLUE WIRE)	CIRC BRKR, TRICKLE CHARGE (ELECT MOUNTING PLATE)
B			**TEMP--A--START**	
B,F	402	12	CIRCUIT BREAKER, 25 AMP IGN POWER	MODULE, RED WIRE(PWR IN)
B,F	402A	12	SWITCH, IGN(COIL TERM)	MODULE, GREEN WIRE(IGN ON)
B,F	402B	12	MODULE, BLUE WIRE(ENG RUN)	CIRC BRKR, 10A(IGN CONTR'D)
F	402B	12	CIRC BRKR, 10A(IGN CONTR'D)	CONNECTOR, OVERRIDE
B,F	402C	12	BUTTON START	MODULE,YELO WIRE(AUTO STRT)
B,F	402D	14	MODULE, ORANGE WIRE(OIL TEMP)	SENSOR, ENGINE OIL TEMP
B,F	402E	14	MODULE, WHITE WIRE(OIL PRESS)	SWITCH, ENGINE OIL PRESS
B,F	402F	14	NO LONGER USED	
B,F	402G	12	MODULE, BLACK WIRE(GND)	GROUND, ENGINE
B,F	402H	12	CONNECTOR, OVERRIDE	MODULE, PUR WIRE(RELAY)
B,F	402J	14	MODULE, BROWN WIRE(FAST IDLE)	ENGINE, NEAR FUEL SOLENOID
B,F	402K	12	MODULE, PINK WIRE(BATT KEY)	SWITCH, IGNITION(BAT TERM)
B,F	402L		NO LONGER USED	
B,F	402L1	14	MODULE, GRAY WIRE(TILT 1)	SWITCH, CAB TILT
B,F	402L2	14	SWITCH, CAB TILT	MODULE, GRAY WIRE(TILT 2)
F	402M	12	SWITCH, IGNITION(BATT TERM)	CONNECTOR, OVERRIDE
F	402M	12	CONNECTOR, OVERRIDE	RELAY, MASTER(TERM #87)
F	402M	14	SWITCH, NEUTRAL, N.C.	SWITCH, PARK BRK, N.C.

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
F	402N	14	SWITCH, TILT, N.C.	SWITCH, NEUTRAL, N.C.
F	402N1	14	MODULE, RED WIRE(NEUTRAL 1)	SWITCH,TRANSMISSION NEUTRAL
F	402N2	14	SWITCH, TRANSMISSION NEUTRAL	MODULE, BRN WIRE(NEUTRAL 2)
F	402P	14	MODULE, TAN, INTLK IN	SWITCH, TILT, N.C.
F	402P1	14	MODULE, TAN WIRE(PARK 1)	SWITCH, PRESS(PARK BRAKE)
F	402P2	14	SWITCH, PRESS(PARK BRAKE)	MODULE, TAN WIRE(PARK 2)
F	402R	14	RELAY, MASTER(TERM #86)	MODULE, PUR/WHT WIRE(KEY)
H	402S1	16	THRMSTAT, BUNK,TEMPASTART	MODULE,CONTROL,A
H	402S2	16	THRMSTAT, BUNK,TEMPASTART	MODULE,CONTROL,B
H	402S3	16	THRMSTAT, BUNK,TEMPASTART	MODULE, CONTROL,C
B			**HEWITT ELECT FUEL RESTRICTION(SURVEYOR FOUR)**	
B	403	14	CIRCUIT BREAKER	MODULE, RED WIRE
B	403A	14	MODULE, PINK WIRE	SENSOR, ENGINE MOUNTED
B			**ARI TRIP RECORDER**	
B	404	16	CIR BRKR, IGN CONTR'D	MODULE, GREEN WIRE
C	404A	16	CIRCUIT BREAKER, 10 AMP	MODULE, RED WIRE
B	404B	14	MODULE, BLUE WIRE	ENGINE, FRONT OF
B	404C	14	MODULE, GRAY WIRE	ENGINE, FRONT OF
B	404D	14	MODULE, WHITE/BLUE WIRE	TRANSMISSION, REAR OF
B	404E	14	MODULE, WHITE/GRAY WIRE	TRANSMISSION, REAR OF
B	404F	14	MODULE, YELLOW WIRE	HOUSING, ENGINE THERMOSTAT
B	404G	14	MODULE, BLACK WIRE	ENGINE, BLOCK(AHEAD OF BELL HOUSING)
B	404H	14	MODULE, BROWN WIRE	ENGINE, REAR OF FUEL PUMP
B	404J	14	MODULE, ORANGE WIRE	SWITCH, PTO
B	404K	14	MODULE, YELLOW/BLACK WIRE	SWITCH, TWO SPEED AXLE
F	404L	16	MODULE, WHITE WIRE	SWITCH, STOP LIGHT
G	404M	16	SW,G-FORCE,TRIP RCDR, PWR	CIRCUIT BREAKER
G	404N	16	RCDR INPUT-G FORCE	SWITCH-G FORCE
G	404P	16	RCDR RESET SIG	SWITCH-RESET

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
G	404R	16	SW–PWR, RCDR RESET	CIRCUIT BREAKER
G	404S	16	ALARM–TRIP RCDR, PWR	MODULE–TRIP RCDR
D			**STEMCO ELECTRONIC RECORDER**	
D	405	14	SENSOR, TRANSMISSION	MODULE, YELLOW WIRE
D	405A	14	SENSOR, TRANSMISSION	MODULE, BROWN WIRE
D	405B	14	SENSOR, RPM	MODULE, VIOLET WIRE
D	405C	14	SENSOR, RPM	MODULE, GREEN WIRE
D	405D	16	MODULE, ORANGE WIRE	LAMP, INDICATOR
E			**ARGO FMS1330 RECORDER**	
E	405E	14	SENSOR, TRANSMISSION SPEED	MODULE, ARGO
E	405F	14	SENSOR, TRANSMISSION SPEED	MODULE, ARGO
E	405G	14	SENSOR, FLYWHEEL RPM	MODULE, ARGO
E	405H	14	SENSOR, FLYWHEEL RPM	MODULE, ARGO
E			**FIRE TRUCK ALTERNATING FLASHING RED LAMPS**	
E	406	14	CIRCUIT BREAKER, 15 AMP	SWITCH, FLASHING LAMPS
E	406A	14	SWITCH, FLASHING LAMPS	FLASHER, ALTERNATING
E	406B	14	SWITCH, FLASHING LAMPS	JUNCTION BOX, 7 TERM
E	406C	14	SWITCH, FLASHING LAMPS	LAMP, PANEL INDICATOR
E	406L	14	FLASHER, ALTERNATING	LAMP, LH RED(ABOVE HEADLAMPS)
E	406R	14	FLASHER, ALTERNATING	LAMP, RH RED(ABOVE HEADLAMPS)
E			**FIRE TRUCK CROSS–FIRE LIGHTS**	
E	407	14	CIRCUIT BREAKER, 15 AMP	SWITCH, CROSS–FIRE LIGHTS
E	407	14	SWITCH, CROSS–FIRE LIGHTS	WIRE, COILED AT GRILLE
E	407A	14	SWITCH, CROSS–FIRE LIGHTS	LAMP,PANEL INDICATOR
E			**FIRE TRUCK ALLEY LIGHTS**	
E	408	14	CIRCUIT BREAKER, 15 AMP	SWITCH, ALLEY LAMP

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
E	408A	14	SWITCH, ALLEY LAMP	LAMP, PANEL INDICATOR
E	408L	14	SWITCH, ALLEY LAMP	WIRE, COILED IN LH ROOF
E	408R	14	SWITCH, ALLEY LAMP	WIRE, COILED IN RH ROOF
E			**FIRE TRUCK BIN LIGHTS**	
E	409	12	CIRCUIT BREAKER, 25 AMP	SWITCH, BIN LAMP
E	409	12	SWITCH, BIN LAMP	JUNCTION BOX, 7 TERM
E	409A	12	SWITCH, BIN LAMP	LAMP, PANEL INDICATOR
E	409B	14	JUNCTION BOX, 7 TERM	LAMP, DOOR AJAR INDICATOR
E			**FIRE TRUCK SIREN**	
E	410	14	WIRE, COILED IN ROOF	SPEAKERS, SIREN(BEHIND DASH)
E			**FIRE TRUCK**	
E	411	14	CIRCUIT BREAKER, 15 AMP	SWITCH, CANOPY/INTERIOR LAMPS
E	411A	14	SWITCH	BLOCK, RH TUNNEL TERMINAL
E	411A	14	BLOCK, RH TUNNEL TERMINAL	JUNCTION BLOCK, 7-WAY
E	411B	14	SWITCH	LAMP, PANEL INDICATOR
E	412	16	GAUGE, TACH HEAD(SIG TERM)	MODULE, ISSPRO(SIG TERM)
E	412A	16	MODULE, ISSPRO(NO TERM)	DIODE, BUZZER(INPUT TERM)
E	412B	16	MODULE, ISSPRO(NO TERM)	LAMP, INDICATOR OR BUZZER
E	412C	16	CIRCUIT BREAKER, IGN CONTR'D	MODULE,ISSPRO(COM&POS TERM)
E	412D	16	GAUGE, TACH HEAD(GND TERM)	MODULE, ISSPRO(GND TERM)
E	412E	16	GAUGE, SPEEDO HEAD(SIG TERM)	MODULE, ISSPRO(SIG TERM)
E	412F	16	GAUGE, SPEEDO HEAD(GND TERM)	MODULE, ISSPRO(GND TERM)
E			**SONY GEOSTAR (RGSS)**	
E	414	16	CIRCUIT BREAKER, IGN CONTR'D	MODULE, GEOSTAR
E	414A	16	CIRCUIT BREAKER, CONST POWER	MODULE, GEOSTAR

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
			HI-IDLE GOVERNOR(TOGGLE SWITCH ACTUATED)	
F	415	14	SWITCH, GOVERNOR TOGGLE	VALVE, GOVERNOR SOLENOID (ENGINE MOUNTED)
F	415A	14	SWITCH, PRESSURE(PARK BRAKE)	SWITCH, TOGGLE
F	415B	14	CIRCUIT BREAKER, IGN CONTR'D (PARKING BRAKE)	SW, PRESSURE(PARK BRAKE)
			HI-IDLE GOVERNOR(OIL PRESSURE ACTUATED)	
F	415	14	CIRCUIT BREAKER, IGN CONTR'D	VALVE, GOVERNOR SOLENOID (ELECT MOUNTING PLATE)
F	415C	14	VALVE, GOVERNOR SOLENOID	SWITCH, OIL PRESSURE (TURBO CONVEYOR)
E	416	14	CIRCUIT BREAKER, 15 AMP	TELEVISION, 12V
E	416A	14	CIRCUIT BREAKER, 15 AMP	REFRIGERATOR, 12V
			MOBIL PHONE	
F	417	16	CIRCBRKR,10A CONST POWER	HARNESS, PHONE(RED WIRE)
F	417A	16	CIRCBRKR,10A IGN CONTR'D	HARNESS, PHONE(GRN/BLK WIRE)
F	418	14	CIRC BRKR, 15 AMP	LIGHT, LH TOOL BOX
F	419	14	CIRC BRKR, 15 AMP	LIGHT, RH TOOL BOX
			MILITARY VEHICLE	
F	420A	*	SWITCH, BLKOUT LT(PIN #A)	NOT USED
G	420AA	12	SWITCH-STOPLIGHT, SUPPLY	CIR BRKR-STOPLIGHT, MIL BLKOUT LT
F	420B	*	SWITCH, BLKOUT LT(PIN #B)	DIMMER, PANEL LMP(BRIGHT PWR)
F	420C	*	SWITCH, BLKOUT LT(PIN #C)	SWITCH, STP LT/DOME LT(PWR)
F	420D	*	SWITCH, BLKOUT LT(PIN #D)	CONTROL, BLKOUT DRIVE LT
F	420E	*	SWITCH, BLKOUT LT(PIN #E)	CONTROL, BLKOUT TAIL/MRKR LT
F	420F	*	CIRCUIT BREAKER, 25 AMP	SWITCH, BLACKOUT LIGHT(PWR)
F	420H	*	SWITCH, BLKOUT LT(PIN #H)	CONTROL, TAIL/MARKER LIGHT

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
F	420J	*	SWITCH, BLKOUT LT(PIN #J)	RELAY, TURN SIGNAL CONTROL
F	420K	*	CIRCUIT BREAKER, 25 AMP	SWITCH, BLKOUT PWR(PIN #C)
F	420L	*	CIRCUIT BREAKER, 25 AMP	DIMMER, PANEL LMP(DIM PWR)
F	420M	*	SWITCH, BLKOUT LT(PIN #M)	RELAY, HEADLMP POWER(COIL)
F	420N	*	SWITCH, BLKOUT LT(PIN #N)	RELAY, BLKOUT STOP LT(COIL)
F	420P	*	CIRC BRKR, 15 AMP(24V)	RELAY, 24V TAIL/MRKR LT SPLY
F	420PA	*	RELAY,24V TAIL/MRKR LT SPLY	LT, 24V TAIL/MRKR(POWER)
F	420R	*	CIRC BRKR, 15 AMP(24V)	RELAY, 24V BLKOUT DRV LT(PWR)
F	420RA	*	RELAY, BLKOUT DRV LT(PWR)	LIGHT, 24V BLKOUT DRV LT(PWR)
F	420S	*	CIRC BRKR, 15 AMP(24V)	RELAY, 24V STOP LIGHT(POWER)
F	420SA	*	RELAY, STOP LIGHT(POWER)	LIGHT, 24V STOP(POWER)
F	420T	*	CIRC BRKR, 15 AMP(24V)	RELAY,24V TURN SIG LT(PWR)
F	420TL	*	RELAY, LH TURN SIG	LIGHT,24V LH TURN SIG(PWR)
F	420TR	*	RELAY, RH TURN SIG	LIGHT,24V RH TURN SIG(PWR)
F	420V	*	CIRC BRKR, 15 AMP(24V)	RELAY,BLKOUT MRKR LT(SPLY)
F	420VA	*	RELAY, BLKOUT MRKR LT	LIGHT,24V BLKOUT MKR.(PWR)
F	420W	*	CIRC BRKR, 15 AMP(24V)	RELAY,24V BLKOUT STPLT(SPY)
F	420WA	*	RELAY, 24V BLKOUT STP LT (SPLY)	LIGHT,BLKOUT STOP(POWER)
			MILITARY VEHICLE	
F	421A	*	RELAY, 24V BLKOUT MRKR LT(PWR)	RECEPT,BLKOUT MKR LT(PIN#A)
F	421AA	*	CIRC BRKR, 15 AMP(24V)	RELAY, 24V BLKOUT MKR LT(PWR)
F	421B	*	RELAY, 24V LH FLASHER	RECEPT, LH TURN LT(PIN #B)
F	421BA	*	CIRC BRKR, 15 AMP(24V)	RELAY, 24V LH TURN(POWER)
F	421C	*	RELAY, 24V BLKOUT MRKR LT	RECEPT, BLKOUT MKR LT(PIN #C)
F	421D	*	GROUND, VEHICLE	RECEPT, GROUND(PIN #D)
F	421D	*	SWITCH, 12V ON-OFF(AUX HTR)	PUMP, FUEL(AUX HTR)
F	421E	*	HEATER, 24V AUXILIARY	LAMP, 24V WARN(FLAME DETECTOR)
F	421E	*	RELAY, 24V TAIL LT	RECEPT, TAIL LT(PIN #E)
F	421EA	*	CIRC BRKR, 15 AMP(24V)	RELAY, 24V TAIL LT(POWER)
F	421F	*	RELAY, 24V BLKOUT STP LT(PWR)	RECEPT, BLKOUT STP LT(PIN #F)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
F	421F	*	CIRC BRKR, 15 AMP(24V)	RELAY, 24V BLKOUT STP LT(PWR)
F	421H	*	RELAY, 24V BLKOUT TAIL LT	RECEPT, BLKOUT TAIL LT(PIN#H)
F	421J	*	RELAY, 24V RH FLASHER	RECEPT, RH TURN LT(PIN #J)
F	421JA	*	CIRC BRKR, 15 AMP(24V)	RELAY, RH TURN(POWER)
F	421K	*	RELAY, 24V BLKOUT DRV LT	RECEPT, AUX POWER(PIN #K)
F	421L	*	GROUND, VEHICLE	RECEPT, GROUND(PIN #L)
F	421M	*	RELAY, 24V RH STOP LT	RECEPT, RH STOP LT(PIN #M)
F	421N	*	RELAY, 24V LH STOP LT	RECEPT, LH STOP LT(PIN #N)
F	421P	*	RELAY, 24V BLKOUT DRV LT	LIGHT, BLKOUT DRV(POWER)
F	421PA	*	CIRC BRKR, 15 AMP(24V)	RELAY, 24V BLKOUT DRV LT(PWR)
			MILITARY VEHICLE	
F	422	*	SW, 12V ON-OFF(AUX HTR)	SWITCH, SELECT/RELAY COIL(PWR)
F	422A	*	CIRC BRKR, 15 AMP(24V)	HEATER, 24V AUX(CONST POWER)
F	422B	*	CIRC BRKR, 15 AMP(24V)	HEATER, 24V AUX(RUN POWER)
F	422C	*	CIRC BRKR, 15 AMP(24V)	HEATER, 24V AUX(HIGH POWER)
			MILITARY VEHICLE	
F	423		RESERVED FOR DAVE WIXOM	
F	424	12	HDLT WIPE/WASH SWITCH	FROM BRKR
F	424A	12	HDLT WIPE/WASH MOTOR ASSY	FROM SWITCH
F	425	14	BAT CUTOFF SWITCH SOLENOID	BAT CUTOFF DASH SWITCH
G	425A	12	FUSE SUPPLY-CONST, C/O SW BYPASS	BATTERY-12V
G	425B	12	CAB AUX PWR-CONST 12V	FUSE-BATTERY
F	426	14	IND LT SW, INSIDE/OUTSIDE AIR	IGN CIR BRKR PWR
G,H	427		SATELLITE TRACKING UNIT PWR	CIR BRKR, HOT
H	427A		SATELLITE TRACKING UNIT PWR	CIR BRKR, IGN COIL

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
H	427B		SATELLITE UNIT STOP LT SIGNAL	STOP LT SW OUTPUT
K	427C	16	IND LIGHT SIGNAL, SATELLITE MESSAGE	SATELLITE TRACKING MODULE
K	427D	16	INDICATOR LIGHT SIGNAL, SATELLITE	DISABLE SWITCH
K	427E	16	PANIC SWITCH SIGNAL	SATELLITE TRACKING MODULE
K	427F	16	PANIC SWITCH RETURN	SATELLITE TRACKING MODULE
H	428	14/16	BAT ISOLATOR RELAY COIL	OIL PRESS & BAT BOOST SW
H	428A	14	BAT ISOLATOR RELAY COIL	SUPPLY, PWR
H	429	16	INDLT/BUZZER-PYRO	GAUGE-PYRO,ALARM OUTPUT
H	430	14	SWITCH SUPPLY,WIPER HEATER	CIR BRKR, IGN
H	430A	14	RELAY COIL SPLY,WIPER HEATER	SWITCH,WIPER HEATER
H	430B	14	RELAY SUPPLY,WIPER HEATER	CIR BRKR, HOT
H	430C	14	HEATER,WIPER,SUPPLY	SWITCH/RELAY
J	431		FLAME START SYSTEM	
J	431A	14/16	ALTERNATOR OR OIL PRESSS SW	ENGINE RUN SIGNAL TO MOD
J	431B	10	CONTROL MODULE	GLOW PLUG IGNITER POWER
J	431C	16	CONTROL MODULE	LIGHT,INDICATOR,FLAME-START
J	431D	14/16	CONTROL MODULE	FUEL SOLENOIS VLV SUPPLY
J	431E	14/16	CONTROL MODULE	SENSOR,ENG TEMP SIG
J	431F	14/16	IGNITION SWITCH CIRCUIT	IGNITION SIGNAL TO MODULE
J	431G	10	CIR BRKR/FUSE	MODULE SUPPLY, 12V,MAIN
J	431H	14/16	GROUND	MODULE GROUND
J	431J	14/16	STARTER CIRCUIT	STARTER SIG TO MODULE
J	431K	12/14	CONSTANT HOT 12V PWR/BRKR	OIL PRESS SWITCH SUPPLY
K	432	12	POWER SEAT SUPPLY	FUSE/BRKR/RELAY
L	433	16	FUSE/BRKR	ENG DATA DISPLAY,CNST PWR

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
L	433A	16	IGN FUSE/BRKR	ENG DATA DISPLAY,IGN PWR
L	433B	18	LOGGER BOX	DATAHUB,TRANSMIT TO PC
L	433C	18	LOGGER BOX	DATAHUB,RECEIVE FROM PC
L	433D	18	LOGGER BOX	DATAHUB,PC INTERFACE,ACTV
L	433E	18	LOGGER BOX	DATAHUB,CMN REF FOR RS232
L	433F	18	LOGGER BOX	DATA BUS RS485+
L	433G	18	LOGGER BOX	DATA BUS RS485-
L	433H	18	LOGGER BOX	+12V ACC SUPPLY
L	433J	18	LOGGER BOX	ACC COMMON REF
L	434	16	FUSE/BRKR D06-21703	ECAS ECU PWR,PIN-1
L	434A	16	STOP LT CIR	ECAS SRVC BRAKE SIG
L	434B	16	ECAS ECU	IND LT SIG,FAILURE,ECAS
L	434C	16	SWITCH	IND LT SIG,ECAS ON/OFF
L	434D	16	ECAS ECU	ECAS HAND CNTRL DATA SIG
L	434E	16	ECAS ECU	ECAS HAND CNTRL CLOCK SIG
L	434F	16	ECAS ECU	ECAS SOLENOID VLV,PIN-42
L	434G	16	ECAS ECU	ECAS SOLENOID VLV,PIN-43
L	434H	16	ECAS ECU	ECAS SOLENOID VLV,PIN-41
L	434J	16	DISTANCE SNSR	ECAS DISTANCE SIG
L	434K	16	ECAS SPEED SNSR PIN-1	ECAS SPEED SIG PIN-20
L	434L	16	ECAS SPEED SNSR PIN-2	ECAS SPEED SIG PIN-22
L	434M	16	ABS SYSTEM	ECAS ATC SIG
L	434N	16	SWITCH	ECAS LOAD TRNSFR SW SIG
L	435	16	SWITCH,SEAT BELT	IND LT SIG,SEAT BELT WARN
L	435A	16	IGN FUSE/BRKR	IND LT PWR,SEAT BELT WARN
L	436	16	IGN FUSE/BRKR	SPLY,CAMERA/MONITOR
L	436A	16	CAMERA SWITCH BOX	RH TURN CONSTANT PWR
L	436B	16	BKUP LT/RH TURN SIG	MONITOR ON SIG

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CL	CIRC NO	WIRE GA	FROM	TO
F	500		BRAKE PEDAL INPUT	HYDRAULIC BRAKE MODULE
G	501		BUZZER	
G			LOW CYL LEVEL SENSOR	INDICATOR
G	503		TEMPERATURE SWITCH	GLOW PLUG
G	504		BATTERY CHARGER CONNECTOR	
G	505		OPTIONAL GAUGE SENDER	
F	GND		MISC. COMPONENT	CAB/CHASSIS/BATTERY
E			**CATERPILLAR PEEC ELECTRONIC ENGINE**	
E,F	C1	16	ECM, PARK BRAKE	SWITCH, PARK BRAKE
E	C2	14	SWITCH, CRUISE SET/RES (TERM E)	SWITCH, CRUISE SET/RES (TERM B)
E	C2	14	SWITCH, CRUISE SET/RES (TERM B)	SWITCH, CRUISE ON/OFF (TERM C)
E	C2	14	SW.CRUISE ON/OFF(TERM C)	SPLICE, PEEC GROUND
E	C2	14	ECM, SPEED BUFFER	SPLICE, PEEC GROUND
E	C2	14	ECM, THROTTLE SENSOR	SPLICE, PEEC GROUND
E	C2	14	ECM, GROUND	SPLICE, PEEC GROUND
E	C2	12	SPLICE, PEEC GROUND	STARTER, GND TERM
E	C3	14/12	RELAY, PEEC CRANK	ECM, PEEC CRANK POWER
E	C3A	12/14	CIRCUIT BREAKER	RELAY, PEEC CRANK PWR SUPPLY
E	C4	14	ECM, VEHICLE SPEED	SENSOR, VEHICLE SPEED BUFFER

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CL	CIRC NO	WIRE GA	FROM	TO
E	C5	14	ECM, THROTTLE POSITION	SENSOR, THROTTLE POSITION
E	C6	14/16	ECM, CRUISE ON	SWITCH, CRUISE ON/OFF
E	C7	14/16	ECM, BRAKE/CLUTCH	SWITCH, SERVICE BRAKE CUTOFF
E	C7A	16	SWITCH, BRAKE/RETARDER	SWITCH, CLUTCH
E	C7B	14/16	SWITCH, JAKE BRAKE(FWD CYL)	SWITCH, JAKE BRAKE(AFT CYL)
E	C7	14/16	SWITCH, BRAKE	SWITCH, RETARDER
E	C8	14/16	ECM, CRUISE RESUME/COAST	SW,CRUISE SET/RES(TERM A)
E	C9	14/16	ECM, CRUISE SET/ACCELERATE	SW,CRUISE SET/RES(TERM B)
E	C21	14/16	RELAY, PEEC POWER	SPLICE, ECM POWER
E	C21	14/16	SPLICE, ECM POWER	ECM, THROTTLE SENSOR
E	C21	14/16	SPLICE, ECM POWER	ECM, SPEED BUFFER
E	C21	14/16	SPLICE, ECM POWER	ECM, POWER INPUT
E	C32	14/16	ECM, GROUND	SWITCH, CHECK ENGINE
E	C35	14/16	ECM, SELECT	SWITCH, CHECK ENGINE
E	C37	14/16	ECM, LAMP DIAGNOSTIC	LAMP, WARNING(CHECK ENGINE)
E			**DETROIT DIESEL DDEC II ELECTRONIC ENGINE**	
E	D115	18	ECM	MODULE, DDEC COOLANT LEVEL & PROBE, COOLANT LEVE
E	D150	12/16	BATTERY, 12V(NEG TERM)	ECM, DDEC
E	D173	16/14	PROBE, COOLANT LEVEL	MODULE, CONTROL(COOLANT LEVEL)

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CL	CIRC NO	WIRE GA	FROM	TO
E	D240	12	BATTERY, 12V(POS TERM)	FUSE, DDEC
E	D240A	12/16	FUSE, DDEC	ECM, DDEC
E	D241	12	BATTERY, 12V(POS TERM)	FUSE, DDEC
E	D241A	12/16	FUSE, DDEC	ECM, DDEC
E	D417	18	THROTTLE, DDEC	ECM, DDEC THROTTLE SIG
E	D419	16	LAMP, WARNING(CHECK ENGINE)	ECM, CHECK ENGINE(GND)
E	D439	12	SWITCH, IGNITION	ECM, DDEC & MODULE, COOLANT LEVEL, ETC.)
E	D439A	16	CIR BRKR,IGN CONTR'D	CONNECTOR, DDEC DIAGNOSTIC
E	D439B	16	CIR BRKR,IGN CONTR'D	SWITCH, CLUTCH(CRUISE CONTROL)
E	D439C	16	SW,CLUTCH(CRUISE CONTROL)	SWITCH, SERV BRAKE(CRUISE CONTROL)
E	D439D	16	SW,SERV BRAKE(CRS CNTRL)	SWITCH, PARK BRAKE(CRUISE CONTROL)
E	D439E	16	SW,PARK BRAKE(CRS CNTRL)	RELAY, CUTOUT(CRUISE CONTROL)
G	D439F	16	SWITCH–NEUTRAL, SUPPLY	SWITCH–PARK BRAKE
G	D439G	16	RELAY–COIL, SUPPLY	SWITCH–NEUTRAL
E	D451	16	SW, DIAGNOSTIC CONN REQUEST(SIG)	ECTORECM, DIAGNOSTIC
E	D505	16/18	CONNECTOR, DIAGNOSTIC	ECM, TACH DRIVE(SIG)
E	D508	16/18	ECM, IDLE POSITION(GND SIG)	RELAY, THROTTLE CUTOUT
E	D509	16	LAMP, WARNING(STOP ENGINE)	ECM, STOP ENGINE(GND)
E	D510	16/18	ECM, PTO CONTROL(SIG)	SWITCH, PARKING BRAKE
E	D510C	16	SWITCH, PARKING BRAKE	SWITCH, PTO/FAST IDLE
E	D510D	16	SWITCH, PTO/FAST IDLE	RESISTOR, POTENTIOMETER

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CL	CIRC NO	WIRE GA	FROM	TO
E	D524	16/18	ECM,PWR CONTR'L TIMER(SIG)	SWITCH/RELAY, SHUTDOWN
E	D524A	16	CIRCUIT BREAKER	SWITCH, ENGINE TIMER
E	D524B	16	SWITCH, ENGINE TIMER	RELAY, ENGINE TIMER
E	D524C	16	DIODE, IGN CIRCUIT BREAKER	RELAY, ENGINE TIMER LATCH
E	D524D	16	SWITCH, OIL PRESS(ENG TIMER)	RELAY, ENGINE TIMER
E	D524E	16	SWITCH, PARK BRAKE(ENG TIMER)	SWITCH,OIL PRESS(ENG TIMER)
E	D528	16/18	SWITCH, SHUTDOWN OVERRIDE	ECM, SHUTDOWN OVERRIDE(SIG)
E	D531	16/18	SWITCH, BRAKE(CRS CNTRL)	ECM, BRAKE/CLUTCH(ON)
E	D531	16/18	SWITCH, CLUTCH(CRS CNTRL)	ECM, BRAKE/CLUTCH(ON)
E	D531	16/18	RELAY, CRUISE CONTROL	ECM, BRAKE/CLUTCH(ON)
E	D541	16	SWITCH, CRUISE(SET/COAST)	ECM, CRUISE SET/COAST(ON)
E	D542	16	SWITCH, CRUISE(SET/COAST)	ECM, CRUISE SET/COAST(OFF)
E	D543	16/18	SWITCH, BRAKE(CRS CNTRL)	ECM, BRAKE/CLUTCH(OFF)
E	D543	16/18	SWITCH, CLUTCH(CRS CNTRL)	ECM, BRAKE/CLUTCH(OFF)
E	D543	16/18	RELAY, CRUISE CONTROL	ECM, BRAKE/CLUTCH(OFF)
E	D544	16	SWITCH, CRUISE(RESUME/ACCEL)	ECM, RESUME/ACCEL(OFF)
E	D545	16	SWITCH, CRUISE(RESUME/ACCEL)	ECM, RESUME/ACCEL(ON)
E	D555	16	LAMP, INDICATOR(CRUISE ON)	ECM, CRUISE ON(GND)
E	D900	16/18	CONNECTOR, DIAGNOSTIC	ECM, DATA LINK(+)
E	D901	16/18	CONNECTOR, DIAGNOSTIC	ECM, DATA LINK(-)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
E	D902	16/18	CONNECTOR, DIAGNOSTIC	ECM, CRANK POSITION(+ SIG)
E	D908	16/18	ECM, PWM THROTTLE(% SIG)	MODULE,ATEC MODULATOR ADPTR
E	D916	18	ECM, 5V SENSOR SUPPLY	SENSOR,THROTTLE PEDAL(FAST)
E	D952	18	ECM, SENSOR GROUND	SENSOR,THROTTLE PEDAL(IDLE)
H	D953	16	GROUND CIRC,MISC ELEC	BATTERY GROUND
H	D953A	16	GROUND,CRUISE ON SIG	CRUISE ON/OFF SW
H	D953B	16	CRUISE ON/OFF SW SUPPLY	CRUISE INTERRUPT RELAY
L	D953C	16	ENG BRK DASH SW INPUT	ENG BRK FOOT SW OUTPUT
			ALLISON ELECTRONIC AUTOMATIC TRANSMISSION	
E	E02	14	RELAY, ATEC POWER (DDA CIRC NO 202A)	ECU, POWER
E	E02A	12	SWITCH, IGNITION(POWER)	DIODE, ATEC RELAY POWER
E	E02B	14	CIRCUIT BREAKER	RELAY, ATEC POWER
E	E02C	14	DIODE, IGNITION POWER	RELAY, ATEC POWER/DIODE, CHECK TRANSMISSION
E	E03	14	CIRCUIT BREAKER (DDA CIR NO 203)	ECU, ATEC POWER & SWITCH, ATEC OIL PRESSURE
E	E03A	14	SWITCH, ATEC OIL PRESSURE DIODE, CHECK TRANSMISSION	RELAY, CHECK TRANSMISSION
E	E05	14/16	ECU, MPH SIGNAL (DDA CIR NO 205)	GAUGE, SPEEDO(CIRC #117)
E	E06		NOT USED	
E	E08	14/12	ECU, GROUND (DDA CIR NO 208)	BATTERY, GROUND

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
E	E09	14/16	ECU, GROUND (DDA CIR NO 209)	BATTERY, GROUND
E	E14	14/16	ECU, REVERSE(GND SIG) (DDA CIRC NO 214)	RELAY, BACKUP LIGHT
E	E15	14/16	ECU, CHK TRANS(GND SIG) (DDA CIRC NO 215)	RELAY, CHECK TRANSMISSION
E	E16	14/16	ECU, TEST MODE (DDA CIRC NO 216)	BUTTON, TRANSMISSION CHECK
E	E23	14/16	ECU, SPECIAL POWER (DDA CIRC NO 223A)	RELAY, ATEC POWER
	E24		NOT USED	
E	E25	14/16	ECU, SELECTOR (PWR) (DDA CIRC NO 225)	RELAY, ATEC POWER
E	E30	14/16	ECU, SELECTOR(GND) (DDA CIRC NO 230)	BATTERY, 12V(NEG TERM)
E	E31	14/16	ECU, NEUTRAL(GND SIG) (DDA CIRC NO 231)	RELAY, START(NEUTRAL)
	E32		NOT USED	
E	E33	14/16	ECU, SELECTOR(DIMMER) (DDA CIRC NO 233)	LIGHT, PANEL LAMP DIMMER
E	E34	14/16	ECU, SELECTOR(GND) (DDA CIRC NO 234)	BATTERY, 12V(NEG TERM)
E	E43	14/16	RELAY, CHK TRANS	LIGHT,WRNG(CHK TRANS,GND)
E	E104	16/18	ATEC, MODULATOR HARNESS	MODULE, DDEC II ADAPTER (BLUE WIRE)

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
E	E106	16/18	ATEC, MODULATOR HARNESS	MODULE, DDEC II ADAPTER (BLACK WIRE)
K	E114	16	AUTO TRANS OUTPUT SIG #1(PRGRMABLE)	WORLD TRANS ELECTRICAL CONTROL UNIT
E	E124	16/18	ATEC, MODULATOR HARNESS	MODULE, DDEC II ADAPTER (RED WIRE)
K	E124	16	AUTO TRANS RETARDER ON SIGNAL	WORLD TRANS ELECTRICAL CONTROL UNIT
			CUMMINS (PACE) ELECTRONIC ENGINE	
E	N2	18	ECM, CRUISE ON(SIG)	SWITCH, CRUISE ON/OFF
E	N3	18	ECM,VEH SPEED SENSOR(INPUT)	SENSOR, MPH
E	N4	18	ECM, CLUTCH SWITCH(INPUT)	SWITCH, CLUTCH
E	N5	18	ECM, C-BRAKE(INPUT A)	SWITCH, 2 CYL C-BRAKE
E	N6	18	ECM, THROTTLE SWITCH(INPUT)	SWITCH, THROTTLE
E	N7	18	ECM,DIGTL VEH SPEED(RETURN)	SENSOR, MPH
E	N8	18	ECM, DATA LINK(INVERTED)	CONNECTOR, DATA LINK
E	N10	18	ECM, +5 VDC SUPPLY	SWITCH, CLUTCH(COMMON)
E	N10	18	ECM, +5 VDC SUPPLY	SWITCH, BRAKE PRESS(COM)
E	N10	18	ECM, +5 VDC SUPPLY	SWITCH, THROTTLE(COMMON)
E	N10	18	ECM, +5 VDC SUPPLY	SWITCH, C-BRAKE(COMMON)
E	N12	18	ECM, CRUISE SET/COAST	SWITCH, CRUISE SET/COAST
E	N13	18	ECM, BRAKE PRESSURE(INPUT)	SWITCH, BRAKE PRESSURE

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
E	N13A	18	ECM, CRUISE BRAKE SW SIG	CRUISE INTERRUPT RELAY
E	N14	18	ECM, ENG POSITION(INPUT)	SENSOR, ENGINE POSITION
E	N15	18	ECM, C-BRAKE(INPUT B)	SWITCH, 4 CYL C-BRAKE
E	N16	18	ECM, STOP ENGINE LAMP(RED)	LAMP, WARNING(STOP ENGINE)
E	N21	18	ECM, DIAGNOSTIC TEST INPUT	SWITCH, CHECK ENGINE
E	N22	18	ECM, CRUISE RESUME/ACCEL	SWITCH, RESUME/ACCELERATE
E	N23	18	ECM, ENG POSITION(RETURN)	SENSOR, ENGINE POSITION
E	N25	18	ECM, CHECK ENG LAMP(YEL)	LAMP, WARNING(CHECK ENGINE)
E	N27	18	ECM,DATA LINK(NONINVERTED)	CONNECTOR, DATA LINK
			WABCO ANTILOCK CIRCUIT NUMBERS	
F	X1	14	ECU PIN #1	VR 1 RELAY PIN #8
F	X1B	14	CIRC #X1	ENG BRK RELAY PIN #86
F	X2	16	ECU PIN #2	LH DRV SLIP SOL VLV
F	X3	18	ECU PIN #3	RH F/R SOL VLV #3,BRN
F	X4	18	ECU PIN #4	RH R/R SOL VLV #3,BRN
F	X5	18	ECU PIN #5	RH R/R SOL VLV #2,BLU
F	X6	18	ECU PIN #6	RH FWD SOL VLV #3,BRN
F	X7	18	ECU PIN #7	RH FWD SOL VLV #2,BLU
F	X8	16	ECU PIN #8	VR 1 RELAY PIN #86
F	X8L	16	CIRC #8	WARN LP RELAY PIN #86
F	X9	16	ECU PIN #9	5A CIR BRKR(OUTPUT)
F	X10	18	ECU PIN #10	RH F/R SOL VLV #2,BLU

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
F	X11	18	ECU PIN #11	ENG BRK RELAY PIN #85
F	X12	16	ECU PIN #12	WHL SLIP IND LP
F	X13	18	ECU PIN #13	RH F/R SENSOR,BRN
F	X14	18	ECU PIN #14	LH F/R SENSOR,BLK
F	X15	18	ECU PIN #15	LH FWD SENSOR,BLK
F	X16	18	ECU PIN #16	RH R/R SENSOR,BRN
F	X17	18	ECU PIN #17	RH FWD SENSOR,BRN
F	X18	18	ECU PIN #18	LH R/R SENSOR,BLK
F	X19	14	ECU PIN #19	VR 2 RELAY PIN #87
F	X20	16	ECU PIN #20	RH DRV SLIP SOL VLV
F	X21	18	ECU PIN #21	LH R/R SOL VLV #3,BRN
F	X22	18	ECU PIN #22	LH R/R SOL VLV #2,BLU
F	X23	18	ECU PIN #23	LH FWD SOL VLV #3,BRN
F	X24	18	ECU PIN #24	LH FWD SOL VLV #2,BLU
F	X25	16	ECU PIN #25	VR 2 RELAY PIN #86
F	X26	16	ECU PIN #26	WARN LP RELAY PIN #30
F	X26L	16	CIRC #X26	TRAC ABS WARN LP
F	X27	16	ECU PIN #27	GROUND
F	X28	18	ECU PIN #28	LH F/R SOL VLV #3,BRN
F	X29	18	ECU PIN #29	LH F/R SOL VLV #2,BLU
F	X30	18	ECU PIN #30	RH F/R SENSOR,BLK
F	X31	18	ECU PIN #31	LH F/R SENSOR,BRN
F	X32	18	ECU PIN #32	LH FWD SENSOR,BRN
F	X33	18	ECU PIN #33	RH R/R SENSOR,BLK
F	X34	18	ECU PIN #34	RH FWD SENSOR,BLK
F	X35	18	ECU PIN #35	LH R/R SENSOR,BRN
F	X36B	14	STLP SW	TRL STLP RELAY PIN #85
F	X36P	12	25A CIR BRKR	TRL STLP RELAY PIN #30
F	X36T	12	CIR #X36K & XAK	7-WAY J-BLK(STLPS)
F	X71	16	5A CIR BRKR	RELAYS PIN #85
F	X71D	16	IGN SW(COIL)	LOCKOUT RELAY PIN #30

NOTE: ALL WIRING IS FOR 12 VOLT NEGATIVE GROUND SYSTEMS UNLESS OTHERWISE NOTED.

CL	CIRC NO	WIRE GA	FROM	TO
F	X71P	16	LOCKOUT RELAY PIN #87A	5A CIR BRKRS
F	X81C	16	10A IGN CIR BRKR	WARN LPS
F	X121	16	ENG BRK ITERTIE	RELAY IN & OUT
F	XAK	16	INFO MOD PIN #AK	CIR,#X36T & X36K
F	XBAT	8	30A OR 90A CIR BRKR	CIR BRKR BUSS
F	XGND	12	4-WAY JCT BLK	MAIN GND
F	XIL	16	INFO MOD PIN #IL	NO TRLR ABS WARN LP
F	XOV	16	INFO MOD PIN #OV	GND
F	XRK	12	INFO MOD PIN #RK	TRL STLP RELAY PIN #87A
F	XR1	14	15A CIR BRKR	VR1 RELAY PIN #30
F	XR2	14	15A CIR BRKR	VR2 RELAY PIN #30
F	XT1	12	25A CIR BRKR	WAB TRL RCPT #1
F	XT2	16	INFO MOD PIN #UA	WAB TRL RCPT #2
F	XT5	16	TRLR ASB WARN LP	WAB TRL RCPT #5
F	XUS	16	INFO MOD PIN #UES	5A CIR BRKR
F	XZS	16	INFO MOD PIN #ZS	5A CIR BRKR

COMPILED	T Y	SHOP PRACTICE HARDNESS ROUTING CAB WIRING	SECTION NUMBER 33-06111
APPRV	PHILLIPS		
ISSUE DATE	10/20/69		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	G		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-008 FOR HARNESS ROUTING,CAB WIRING.

Compiled	T. YOUNG	SHOP PRACTICE HARNESS ROUTING, CAB WIRING	33-06111
Approved	PHILLIPS		
Issued	10-20-69		
Revised	6-23-80	Chg Ltr F **FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 1

GENERAL

Route all wiring safely away from sharp points and edges, movable parts and other possible sources of abrasion, cutting, pinching or crushing. Be aware also of places where later installation of other parts, such as cab cooler, cab lining & insulation, door stops, etc., may cause these types of difficulty.

No splices may be made aside from those already designed into the harness or those specifically allowed by Engineering to meet some special condition.

Wires routed outside the cab should be protected with loom, tape or other covering. (Ref. 33-06101 #4, "PROTECTIVE COVERINGS").

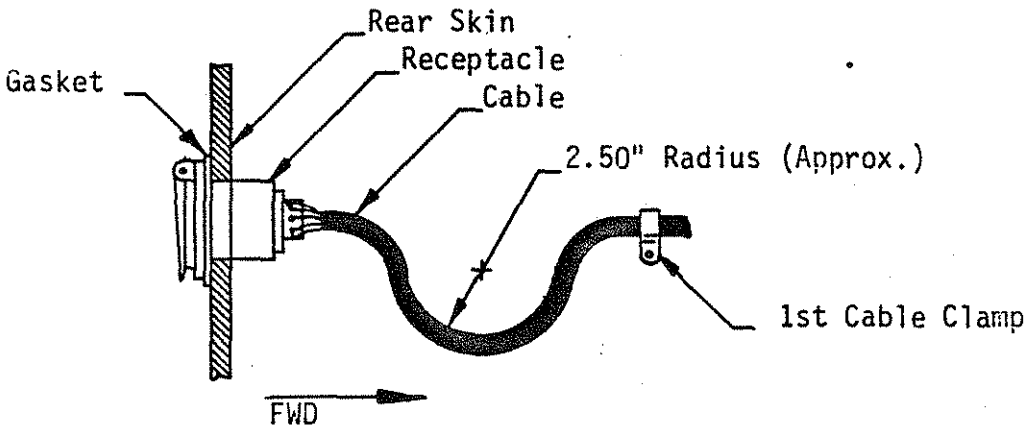
All harnesses within the cab or originating within the cab are to be wrapped with 8.5 mil black vinyl tape (ref. 33-06101, page 2, section D) except where it would impair flexing or pivoting.

Wires routed in the cab overhead are to be covered with loom (ref. 33-06101, page 2, section B) and run through adhesive backed cable clamps. Surfaces to which the clamps attach must be free of all foreign matter for proper adhesion.

F All wiring must be routed so that routinely serviceable components (i.e., fuel filters, fuel water separators, oil filters, air cleaners, dip sticks, belt drives) can be readily accessed for adjustment or element removal without the need to relocate or remove any wires.

REVISED & RETYPED "C" CHG

RECEPTACLE INSTALLATION, CAB REAR (FOR TRAILER CONNECTION)



Allow 8 inches extra cable (see sketch) as a loop to permit pulling the receptacle assembly out of the cab far enough for easy repairs or replacement.

DOOR HARNESS ROUTING

GENERAL

1. When the harness routing is completed and with the door in the 90° open position, the wire bundle should be pulled taut across the top of the mounting plates. The harness is then secured using cable ties (Ref. 23-9796-109) as noted on D22-21285. Any slack should be drawn back into either the door or the cab.

2. Wires can then be trimmed for connection to the main harness lines.

A 3. All wires and hoses of the bundle are to be contained within the conduit for its full length. (Ref. 18-20128)

SPECIFIC ROUTINGS REF. D22-21285 ROUTING DIAGRAM

1. TURN SIGNAL WIRE

   When routing a single turn signal wire, it is to be protected for its full length outside the cab frame with ¼" O.D. plastic loom, typically IB/44EVA ¼" equivalent.

2. TURNSIGNAL & MIRROR HEAT WIRES

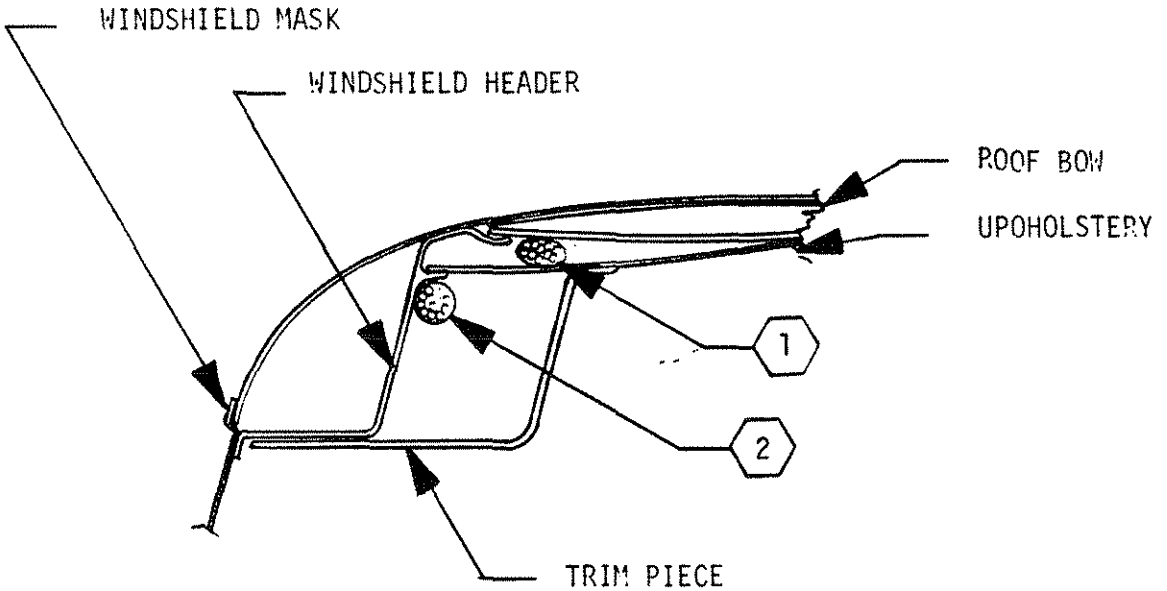
   The protective loom is to run completely into the cab. If it does not, the exposed wires are to be wrapped with black electrical tape. (Ref. 48-00126-007)

B 3. DASH SECTION 'B'

   All wires (Ground, Circuit #82 etc.) captivated by section B panel & the structural rib located between the flipper valves and gauges must be protected by three wraps of 7 mil electrical tape. Apply tape to all areas that would be subjected to wear.

Compiled	McIntosh	SHOP PRACTICE HARNESS ROUTING CAB WIRING	33-06111
Approved			
Issued	10-30-81		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 5

CAB OVERHEAD HARNESS ROUTING

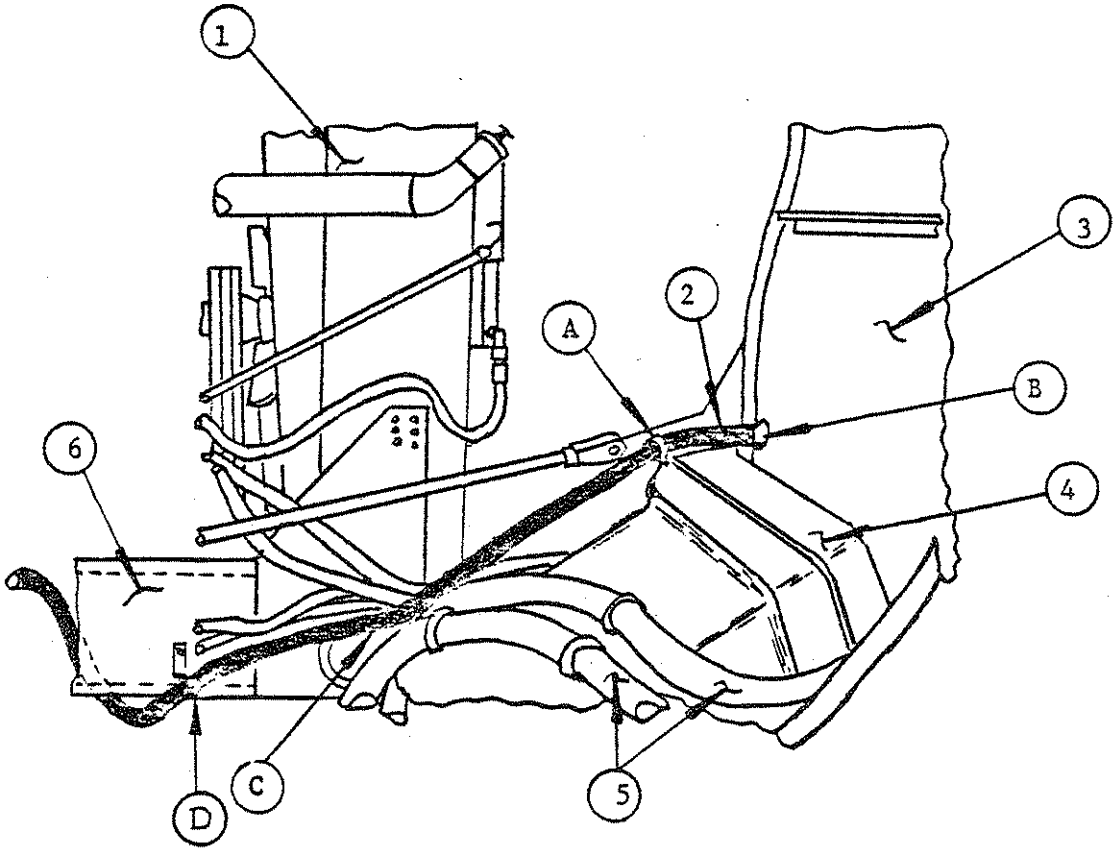


1. ROUTE WIRING BETWEEN ROOF BOWS AND UPOHOLSTERY WHEN OVERHEAD TRIM PIECE IS NOT SPECIFIED

2. ROUTE WIRING ALONG HEADER WHEN TRIM PIECE IS SPECIFIED.

ELECTRIC JUNCTION BLOCK HARNESS

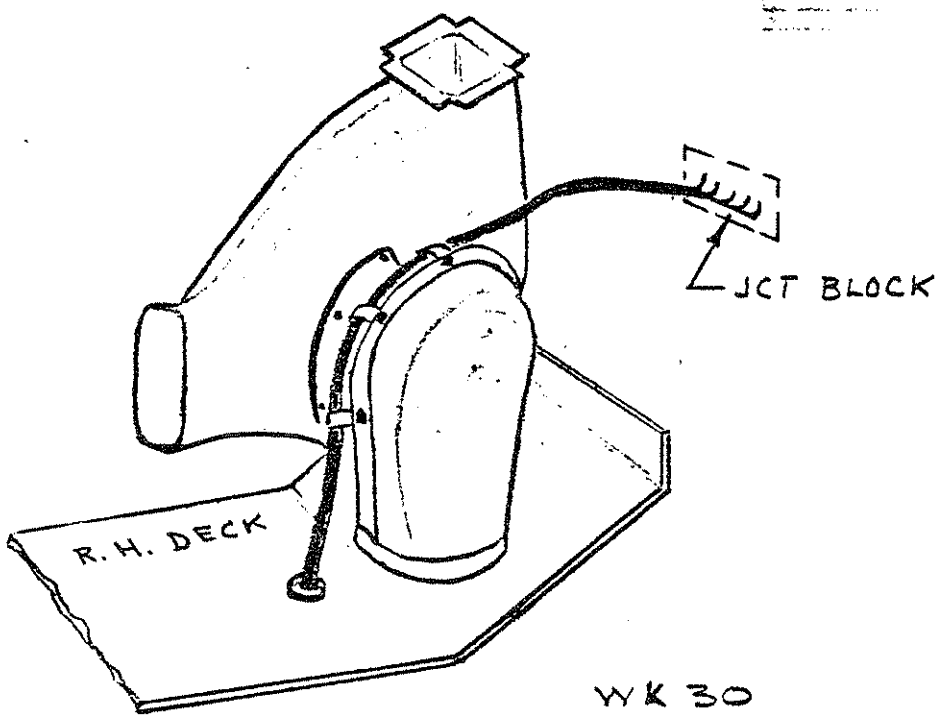
1. Radiator
2. Electric Junction Block Harness
3. RH Deck (Bottom)
4. Heater Core Housing
5. Heater Hoses
6. RH Frame Rail



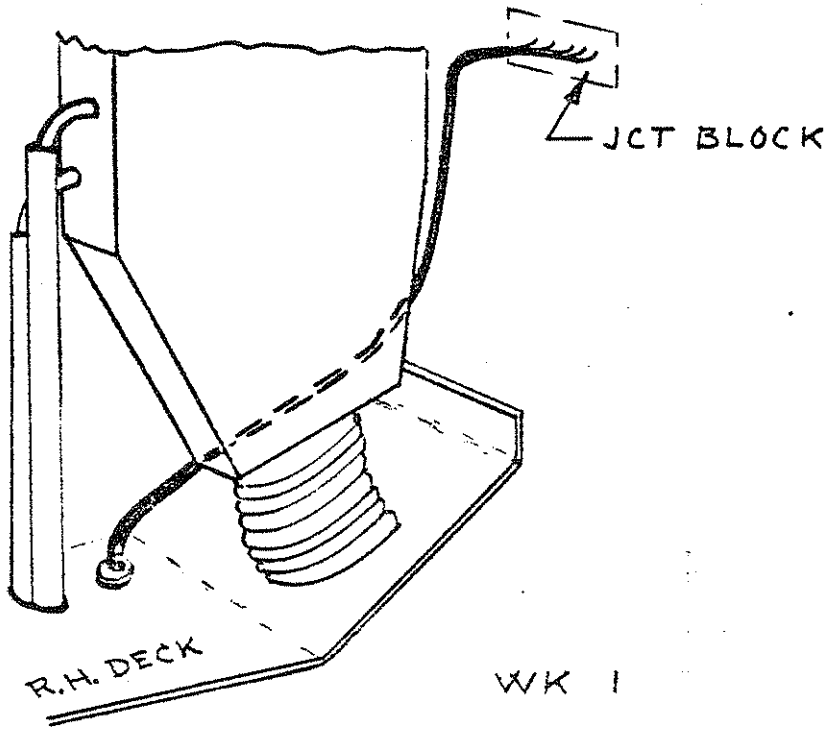
VIEW OF RH WHEEL WELL
(Cab at 90° Tilt)

A Route chassis harness in both directions from a clamp at point (D) on outside of RH frame rail. Clamp harness with hoses to air inlet duct at point (C), then to heater core at point (A). Feed through rubber grommet in RH deck at point (B) to junction block. (Ref. D06-11097)

DASH HARNESS ROUTING AROUND HEATERS

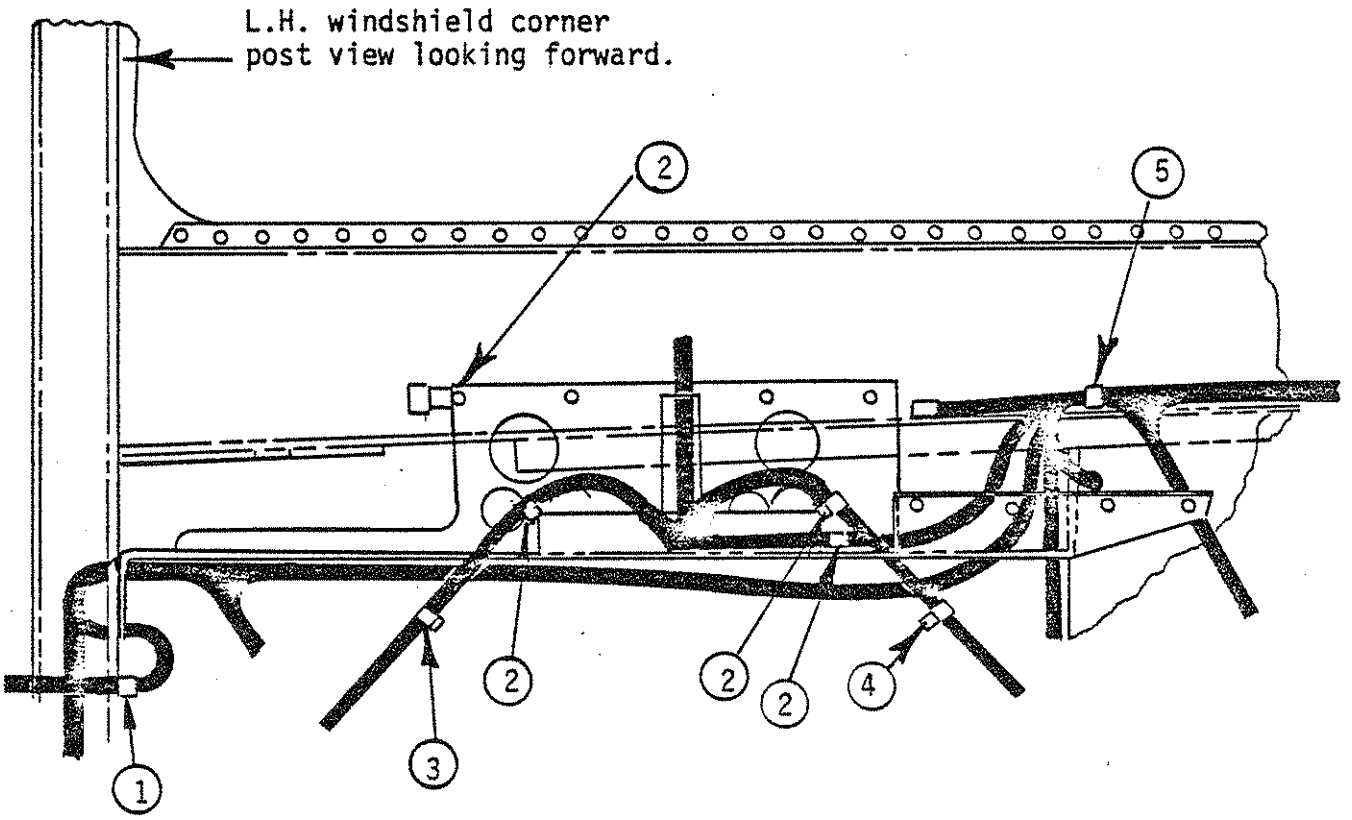


WK 30



WK 1

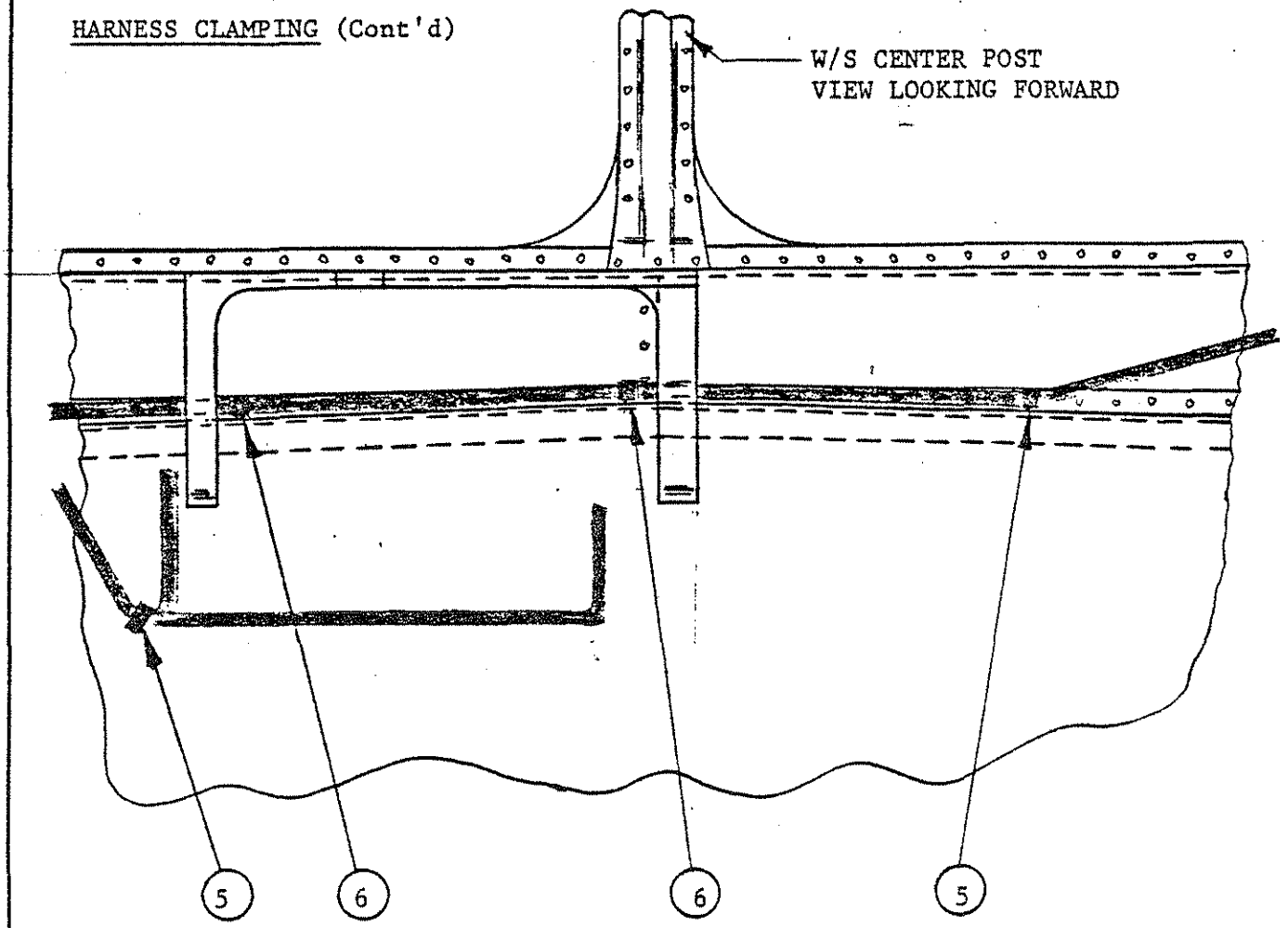
HARNESS CLAMPING



MOUNT CLAMP TO:

1. L.H. Door Post
2. Driver's Cowl Support Bracket
3. L.H. Dash Panel
4. R.H. Dash Panel
5. Tunnel Top

HARNESS CLAMPING (Cont'd)



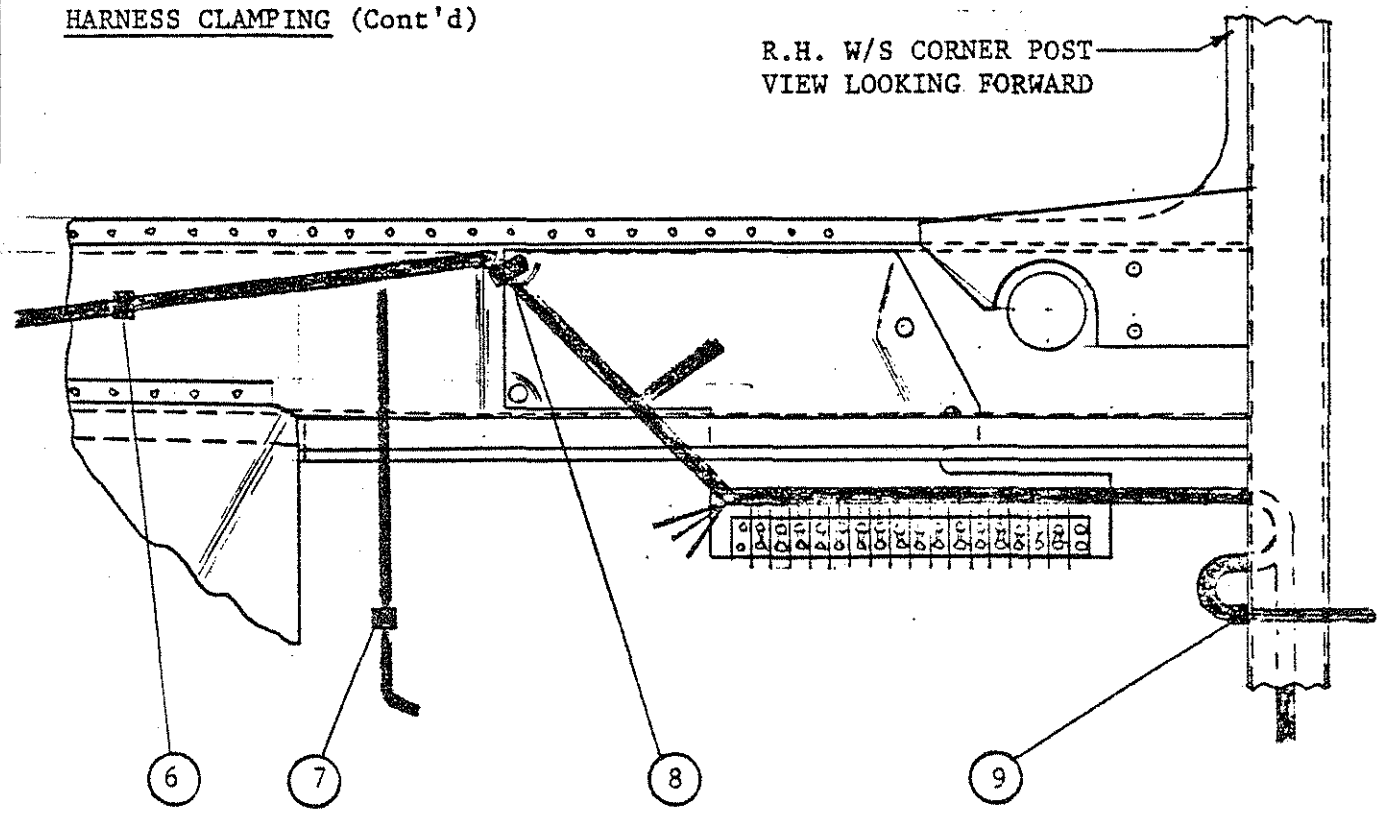
MOUNT CLAMP TO:

(5) TUNNEL TOP

(6) NOSE BEAM

Continued ....

HARNESS CLAMPING (Cont'd)



MOUNT CLAMP TO:

(6) NOSE BEAM

(7) HEATER HOUSING

* (8) VOLT REGULATOR MOUNTING PLATE

(9) R.H. DOOR POST

*On stretch cabs, delete this clamp and run harness directly from Clamp #6 to junction block.

COMPILED	HJR
APPRV	DEC
ISSUE DATE	01/28/66
REV DATE	07/29/96
CHG LTR	C

SHOP PRACTICE

SPARE CONDUCTORS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-06112

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-009 FOR SPARE CONDUCTORS.

Compiled	H.J.R.	SHOP PRACTICE SPARE CONDUCTORS	33-06112
Approved	DEC		
Issued	1-28-66		
Revised	12-3-76	Chg Ltr B	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

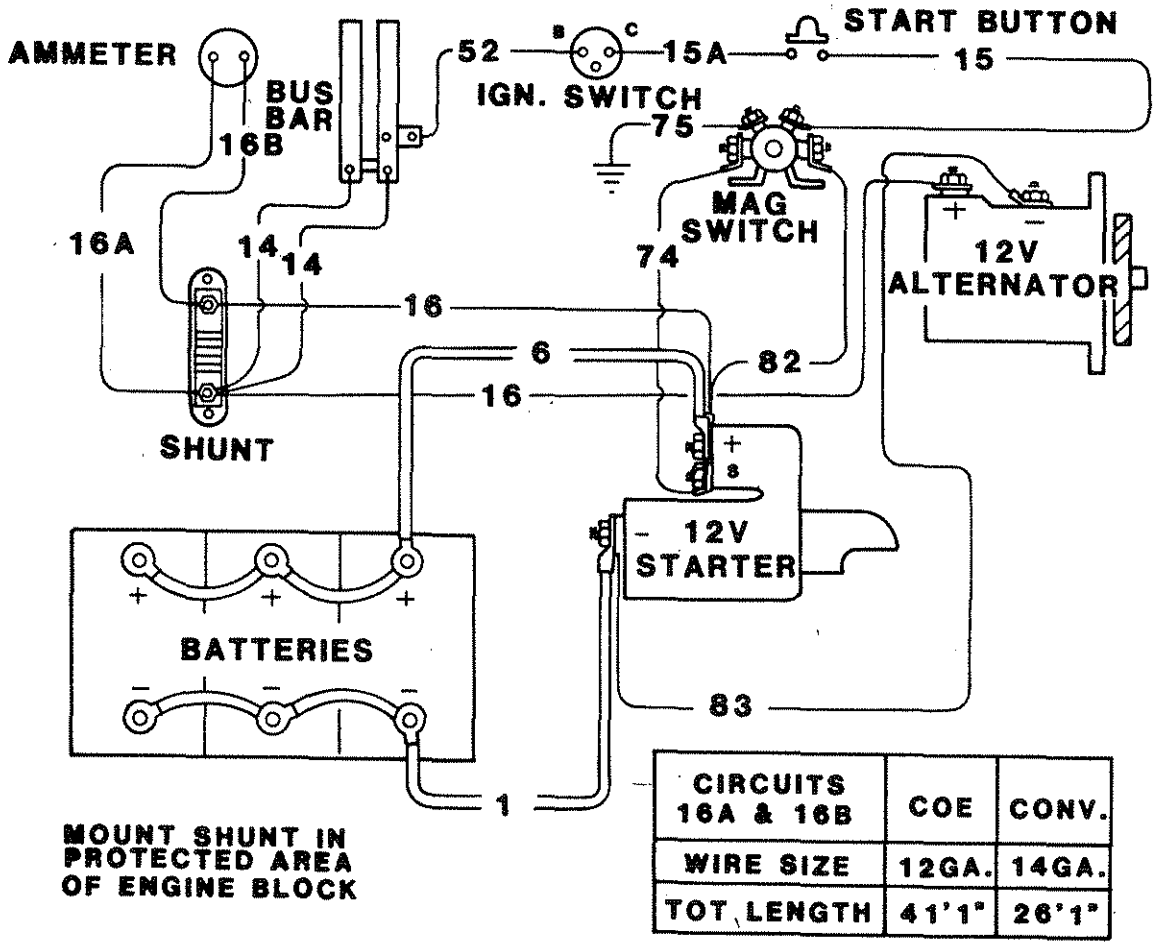
Connect only those circuits which are due to operate some particular function. Spare wires built into a harness should be taped back until required.

REVISED & RETYPED "B" CHG

Compiled	DJL	SHOP PRACTICE AMMETER WIRING	33-06113
Approved	DJL		
Issued	11-06-87		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

A. Ammeter Wiring for 12 Volt System

When an ammeter is specified on vehicles with 12 volt starting, wire as shown below:

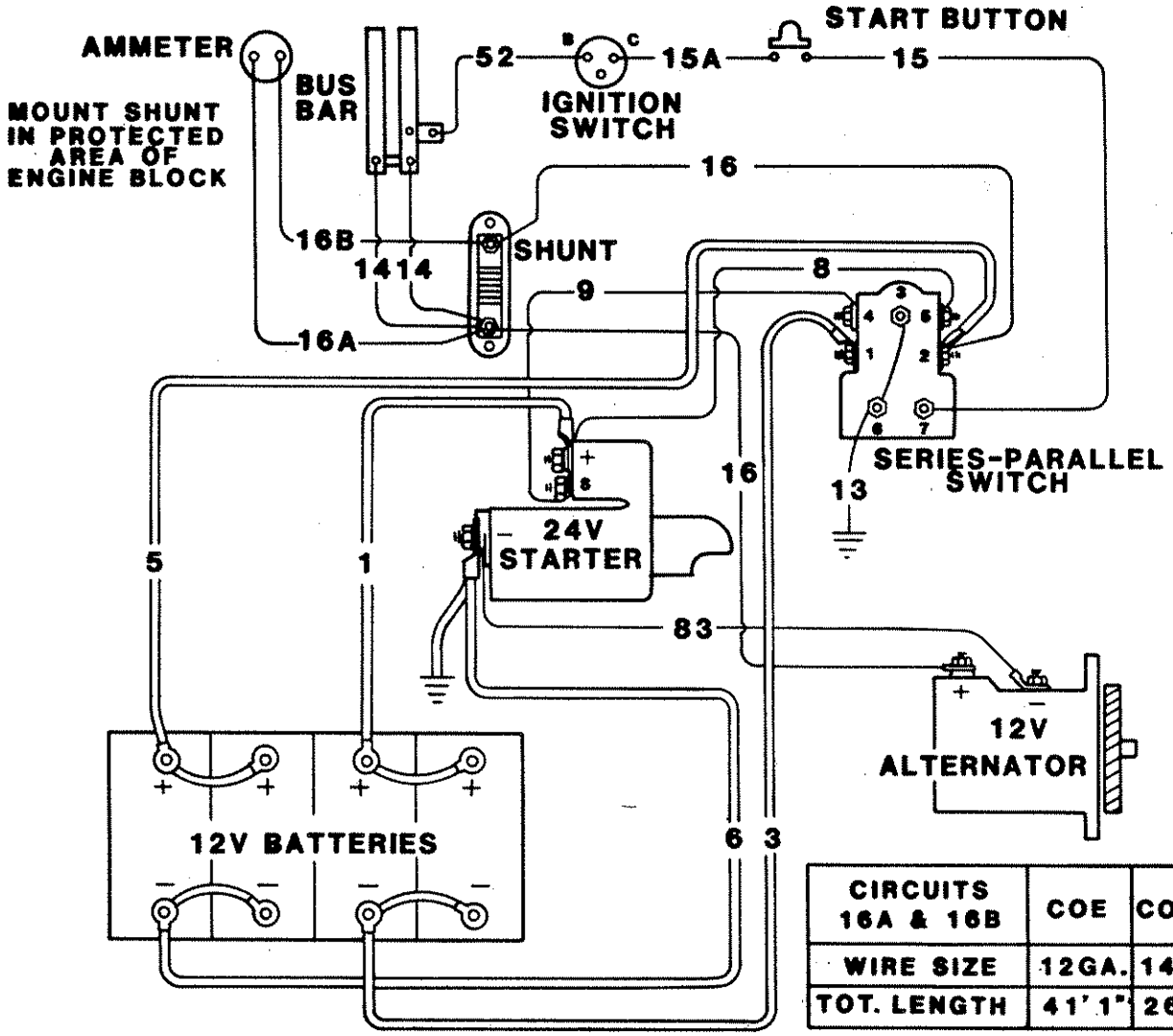


CIRCUITS 16A & 16B	COE	CONV.
WIRE SIZE	12GA.	14GA.
TOT. LENGTH	41'1"	26'1"

NOTE:
1. Do not connect the Circuit 16 wire from the alternator "output" terminal to the starter "battery" terminal.
2. When air starter is used, omit electric starter shown and connect Circuit 16 from the shunt directly to the battery + terminal.
3. If the ammeter reads backwards when a load is placed on the batteries, reverse circuits 16A and 16B either at the ammeter or at the shunt.

B. Ammeter Wiring for 12-24 Volt System

When an ammeter is specified on vehicles with 24 volt starting, wire as shown below:



CIRCUITS 16A & 16B	COE	CONV.
WIRE SIZE	12GA.	14GA.
TOT. LENGTH	41'1"	26'1"

NOTE: 1. Do not connect the Circuit 16 wire from the alternator "output" terminal to the starter "battery" terminal.

2. If the ammeter reads backward when a load is placed on the batteries, reverse circuits 16A and 16B either at the ammeter or at the shunt.

COMPILED	PHILLIPS
APPRV	D L
ISSUE DATE	06/18/73
REV DATE	07/29/96
CHG LTR	F

SHOP PRACTICE

ENGINE HARDNESS INSTALLATION

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-06114

PAGE
1 OF 1

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-010 FOR ENGINE HARNESS INSTALLATION.

GENERAL INSTRUCTIONS

1. Install pre-built engine harnesses prior to engine drop in.

2. The normal procedures of clamping apply to the engine harness. Take care to leave slack between the rail and engine fastening to allow for engine torque.

3. Band the chassis and engine wiring together and cover either with loom or convoluted tubing from the point they leave the protection of the frame rail.
(See 33-06101,"D", "PROTECTIVE COVERINGS & FASTENERS").

4. Clamp the chassis wiring harness to the front of the right-hand frame rail so that Cir. 28 (right-hand road light) breaks from the harness 1.75 inches behind frame rail station 0.00. This clamp is on a stand-off bracket mounted 2.00 behind the trunnion drilling and 2.00 above the bottom of the rail. Convoluted tubing (48-2218-# only) is used to cover the harness from the circuit #28 breakout up thru a grommet in the R.H. deck and to the connectors in the cab. The harness is clamped at the air inlet duct and to the heater core. (Sec. 33-06111 Pg. 3)

5. Any wiring that will be exposed to water or heat must be covered with either loom or convoluted tubing.
(See 33-06101, "D","PROTECTIVE COVERINGS & FASTENERS").

6. Any wiring routed across the vehicle on the engine crossmember or across the rear of the engine must be securely clamped and either covered with loom or convoluted tubing.
(See 33-06101, "D","PROTECTIVE COVERINGS & FASTENERS").

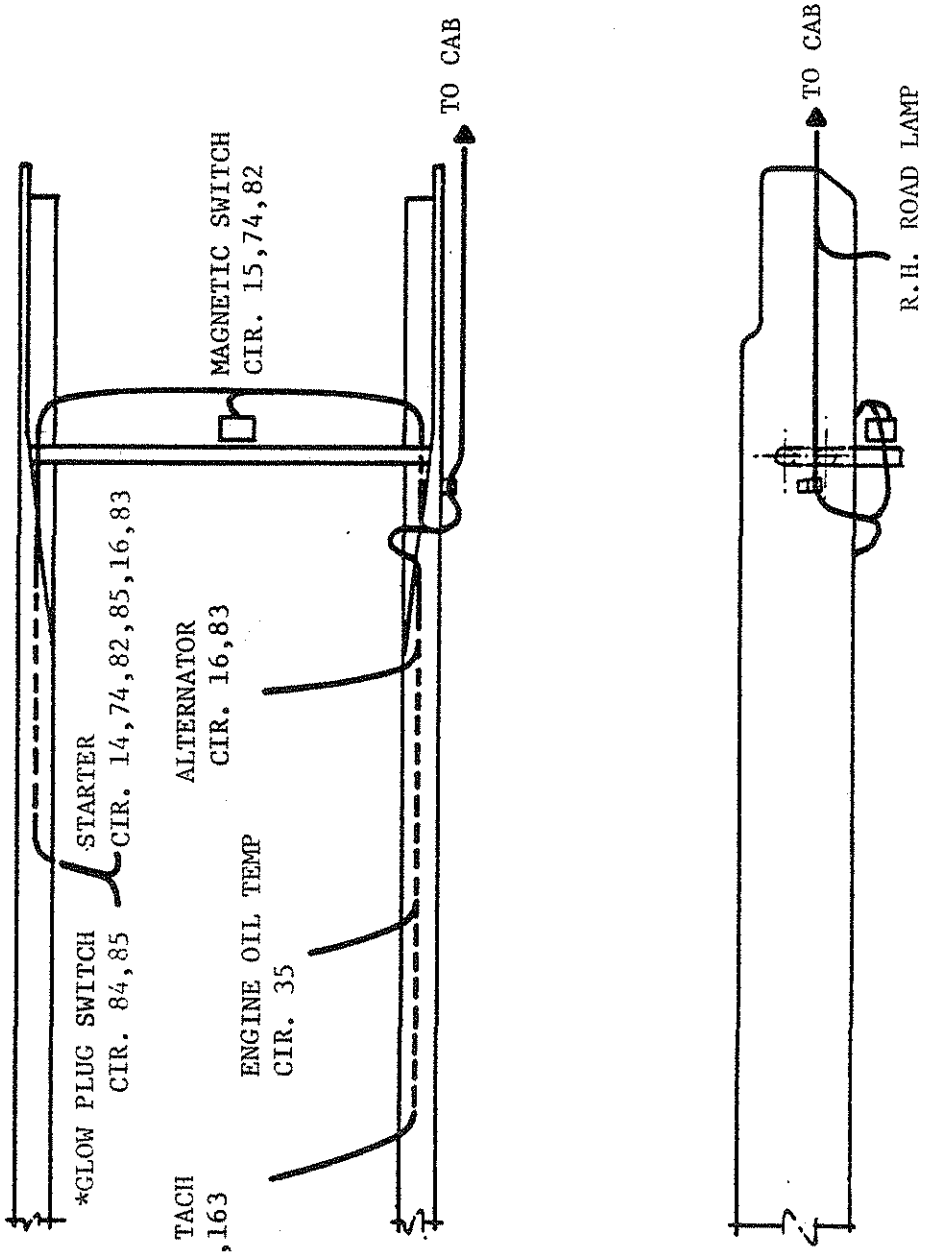
7. All wiring must be routed so that routinely serviceable components (i.e., fuel filters, fuel water separators, oil filters, air cleaners, dip sticks, belt drives) can be readily accessed for adjustment or element removal without the need to relocate or remove any wiring.

E

REVISED & RETYPED "E" CHG

C

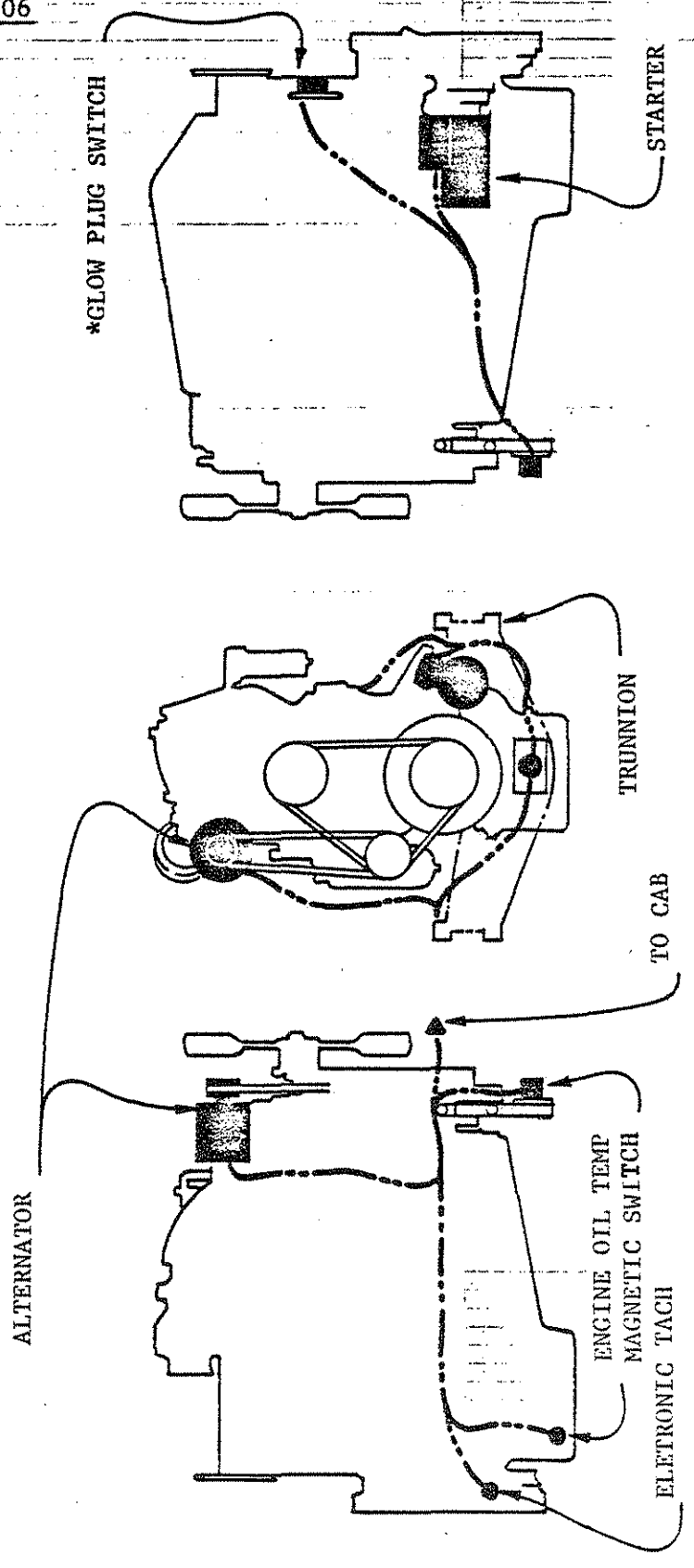
FRAME CONFIGURATION, CAT 1674 AND 3406 SERIES, 12 VOLT SYSTEM.



* NOT USED ON 3406 DIRECT INJECTION TURBO CHARGED (D.I.T.) ENGINES.

REVISED & RETYPED "B" CHG

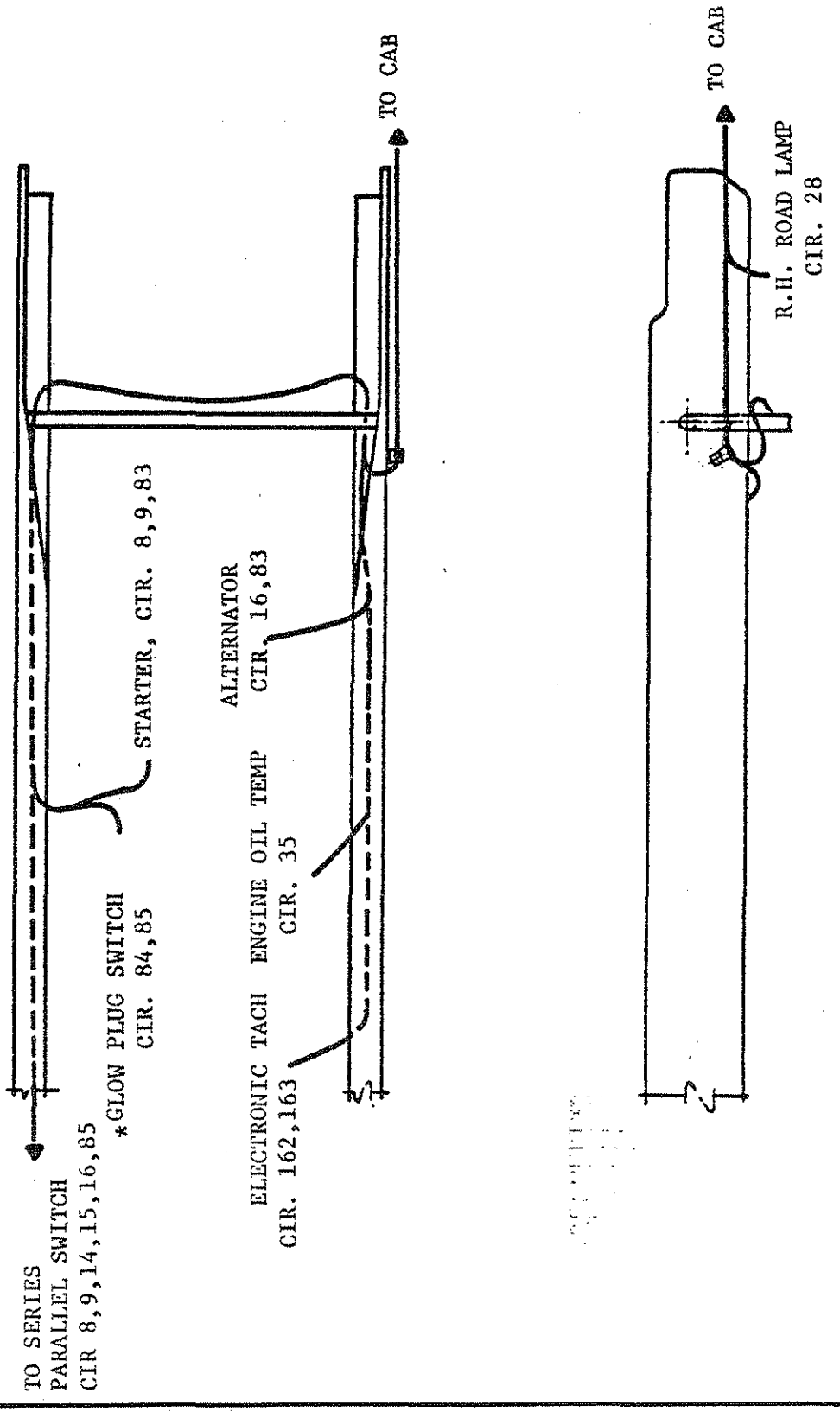
ENGINE, CAT 1674 AND 3406
SERIES
12 VOLT SYSTEM



REVISED & RETYPED "A" CHG

* NOT USED ON 3406 DIRECT INJECTION TURBO CHARGED (D.I.T.) ENGINES.

FRAME CONFIGURATION, CAT 1674 AND 3406 SERIES.
24 VOLT SYSTEM

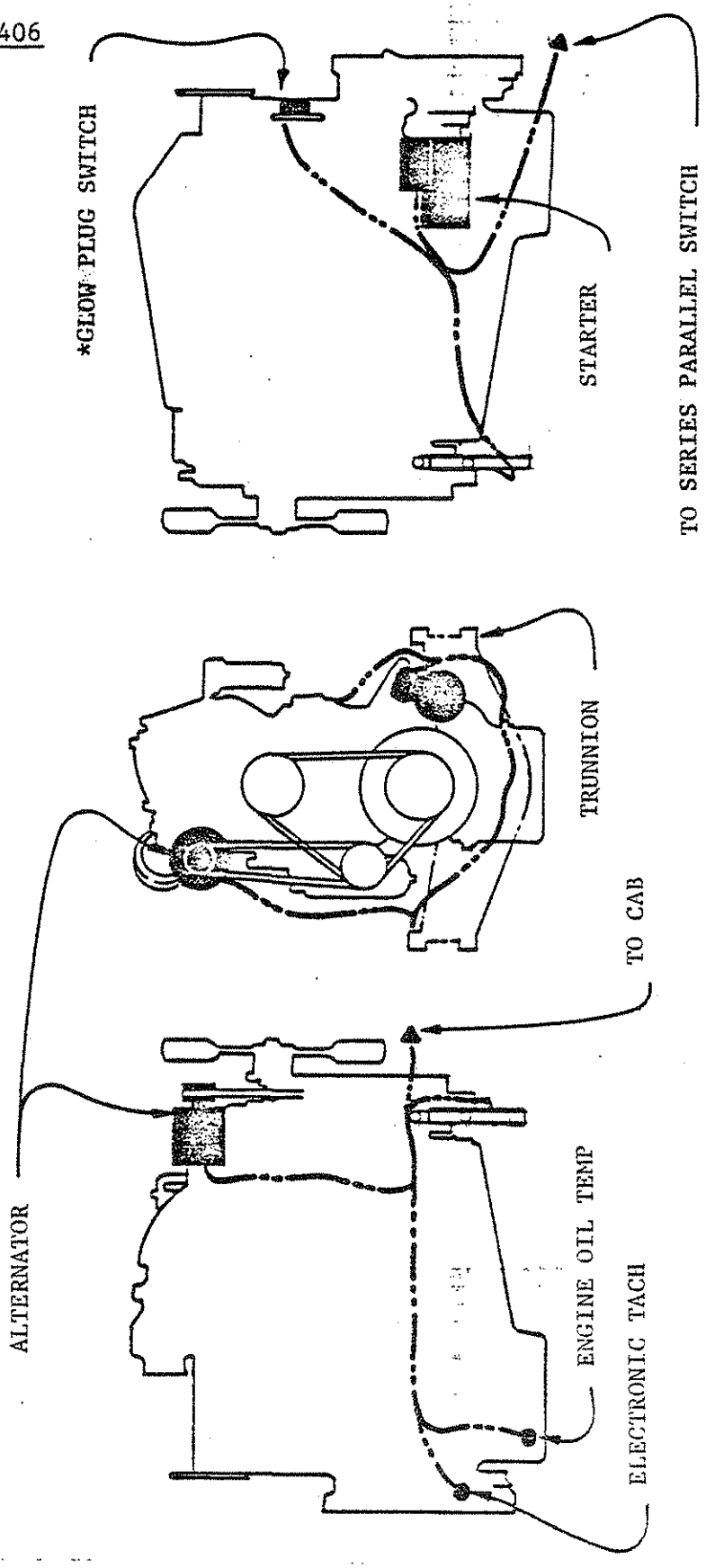


REVISED & RETYPED "B" CHG

* NOT USED ON 3406 DIRECT INJECTION TURBO CHARGED (D.I.T.) ENGINES

Compiled	WILLIAMS	SHOP PRACTICE ENGINE HARNESS INSTALLATION	33-06114
Approved	SOUMOKIL		
Issued	12-6-71	FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 5
Revised	11-13-76	Chg Ltr A	

ENGINE, CAT 1674 AND 3406
SERIES
24 VOLT SYSTEM

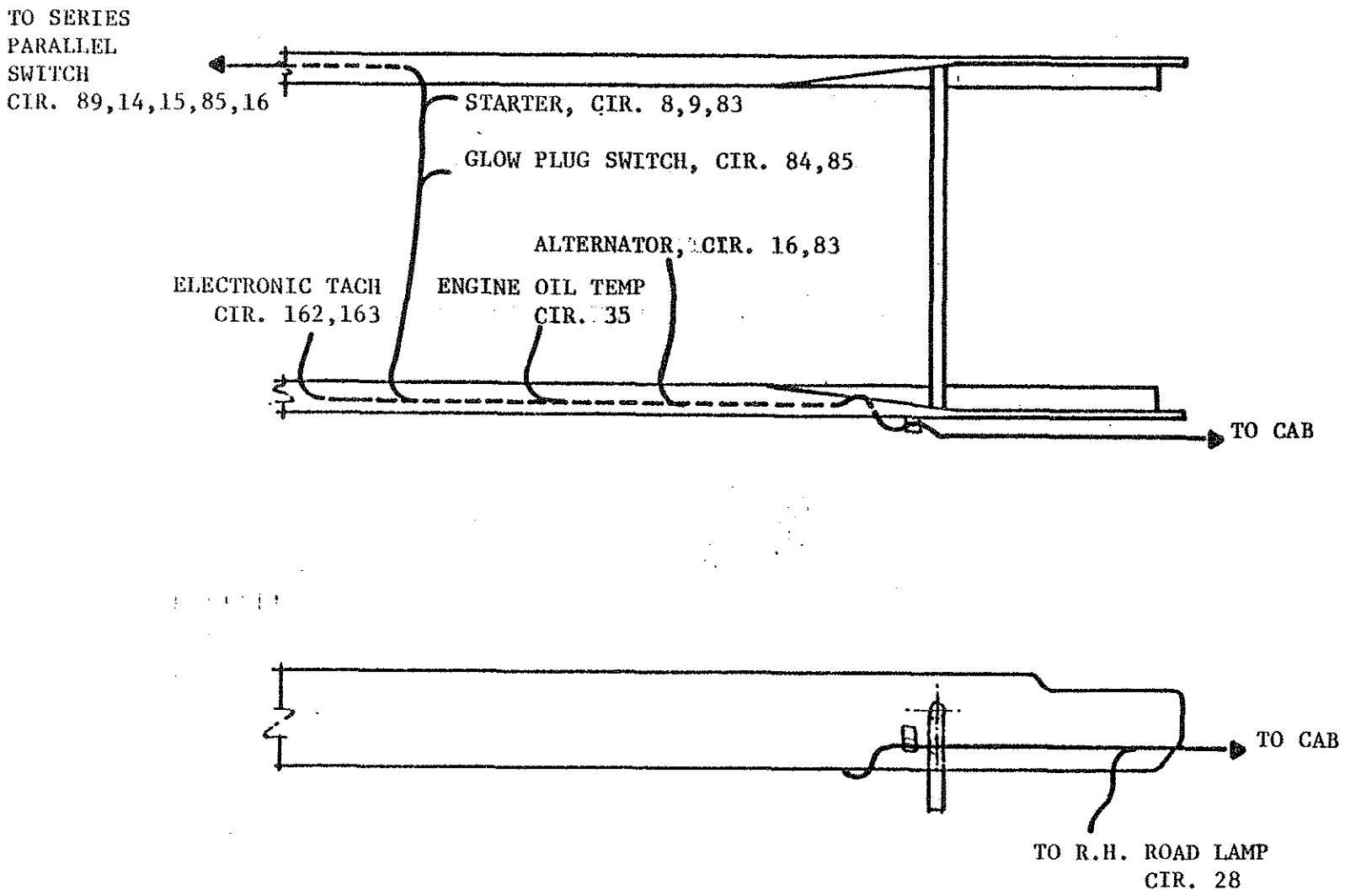


REVISED & RETYPED "A" CHG

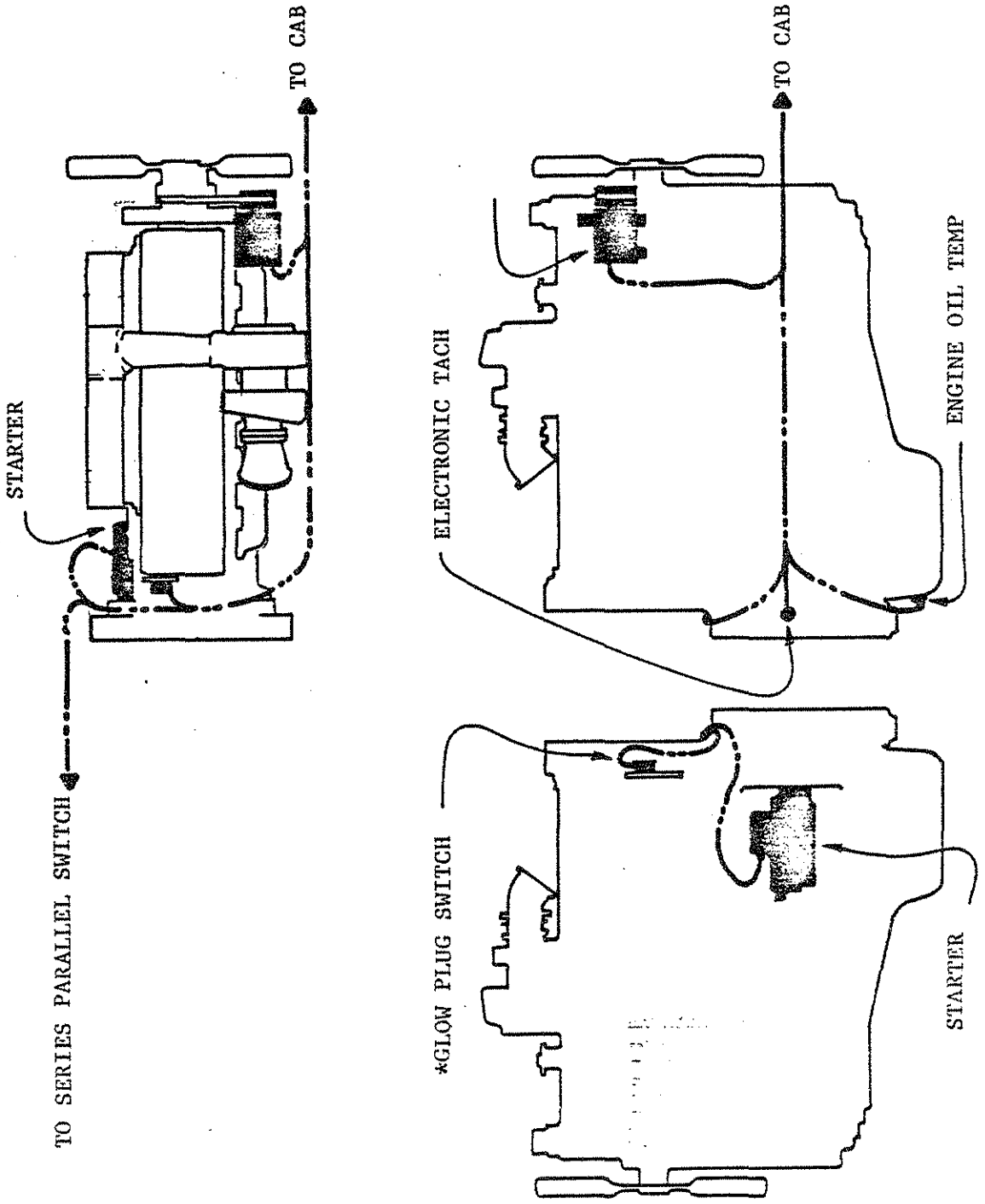
* NOT USED ON 3406 DIRECT INJECTION TURBO CHARGED (D.I.T.) ENGINE

REVISED & RETYPED "C" CHG

FRAME CONFIGURATION, CAT 1693
24 VOLT SYSTEM

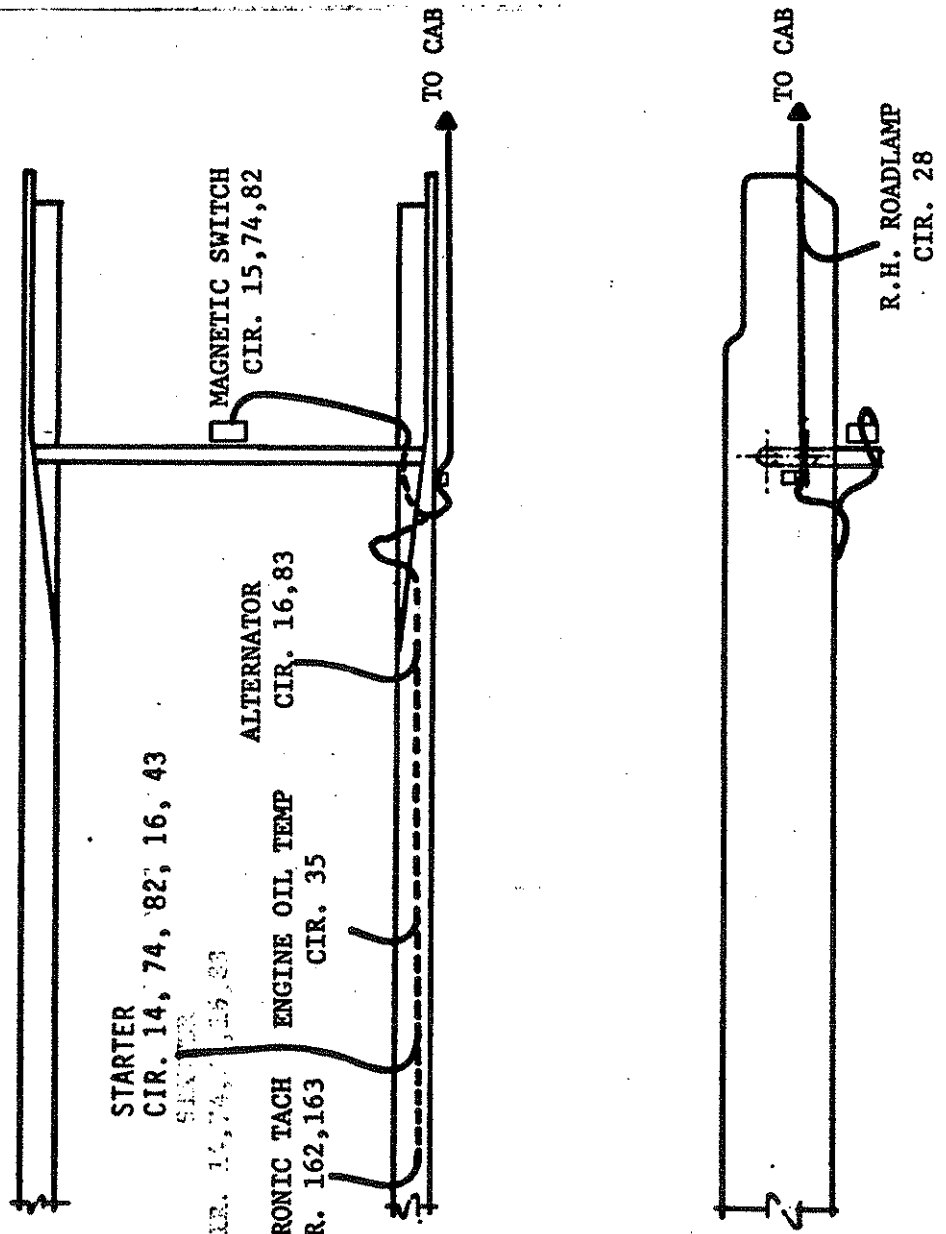


ENGINE, CAT 1693 SERIES
24 VOLT SYSTEM



REVISED & RETYPED "A" CHG

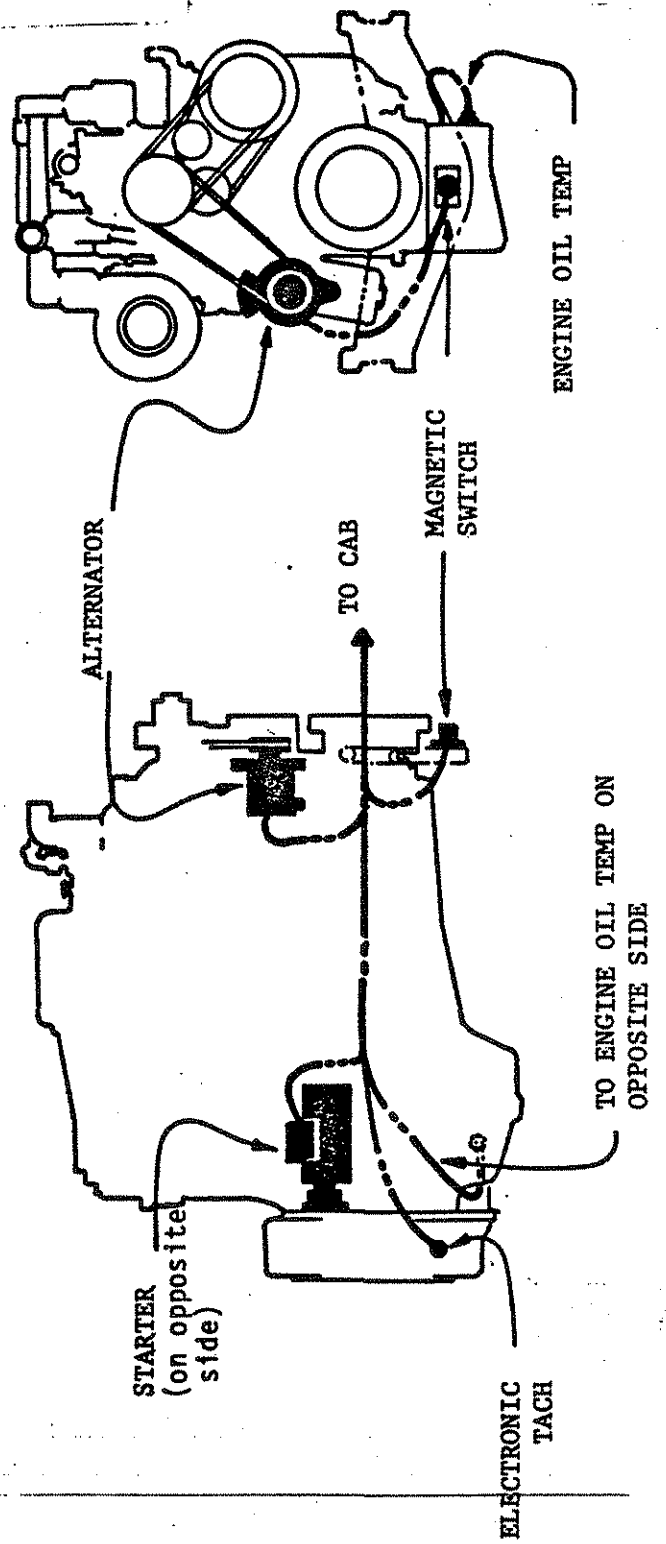
FRAME CONFIGURATION, CUMMINS INLINE BIG CAM III SERIES
12 VOLT SYSTEM



REVISED & RETYPED "B" CHG

B

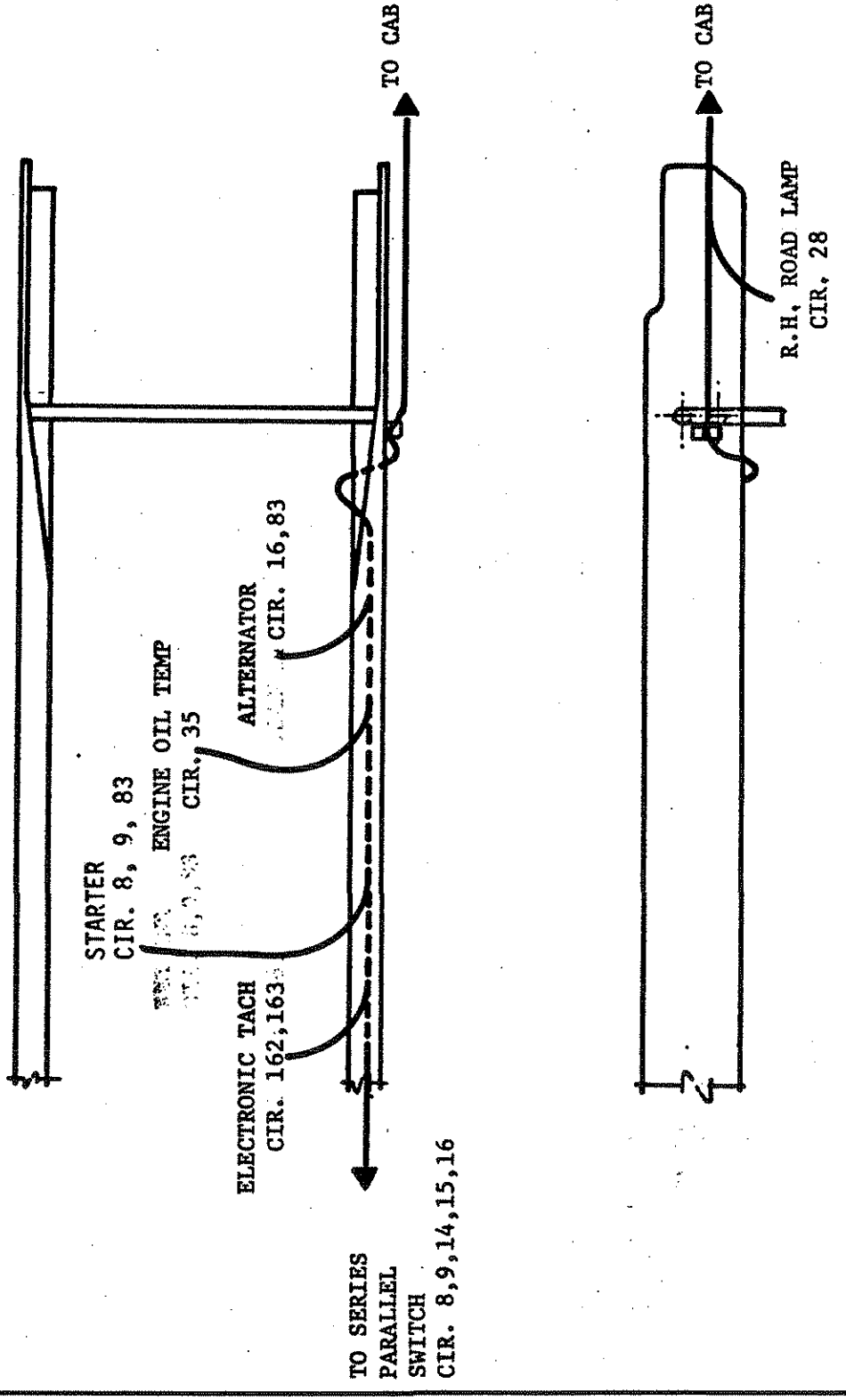
ENGINE CUMMINS INLINE BIG CAM III SERIES
12 VOLT SYSTEM



B

REVISED & RETYPED "A" CHG

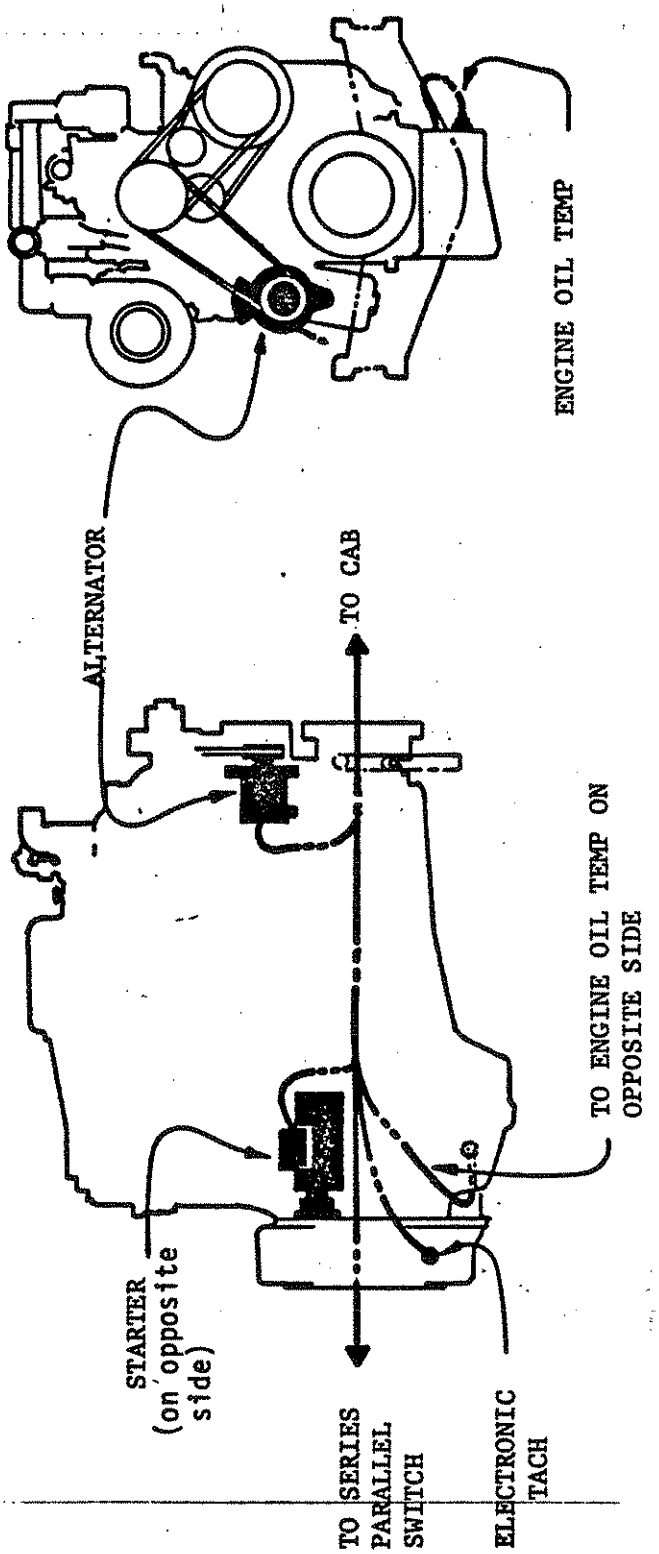
FRAME CONFIGURATION, CUMMINS INLINE BIG CAM III SEFIES
24 VOLT SYSTEM



REVISED & RETYPED "B" CHG

B

ENGINE, CUMMINS INLINE BIG CAM III SERIES
24 VOLT SYSTEM



B

REVISED & RETYPED "A" CHG"

REVISED & RETYPED "C" CHG

Compiled	N.RITCHIE
Approved	E.TRAUB
Issued	6-18-73
Revised	11-13-74
Chg Ltr	C

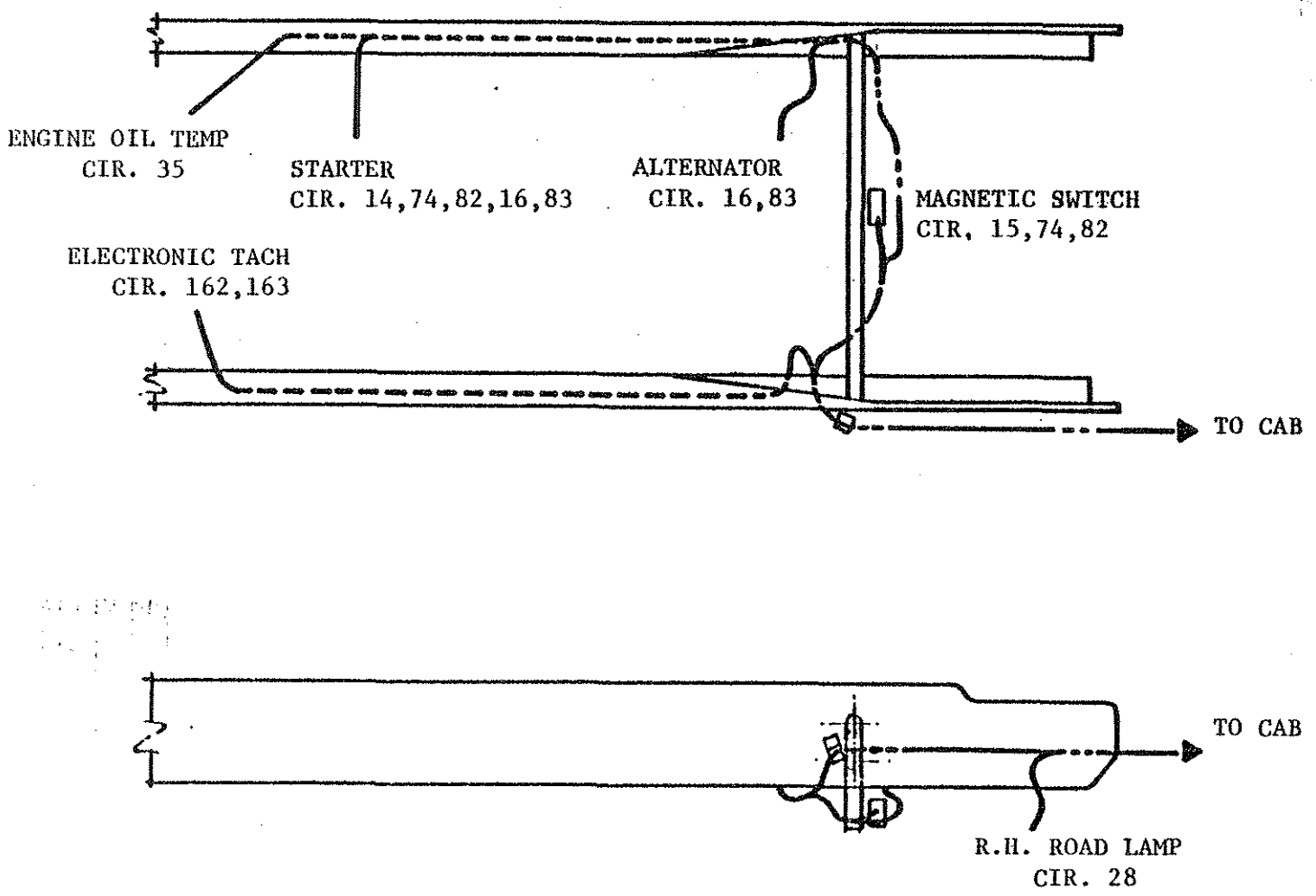
FREIGHTLINER CORPORATION
PORTLAND, OREGON

SHOP PRACTICE
ENGINE HARNESS INSTALLATION

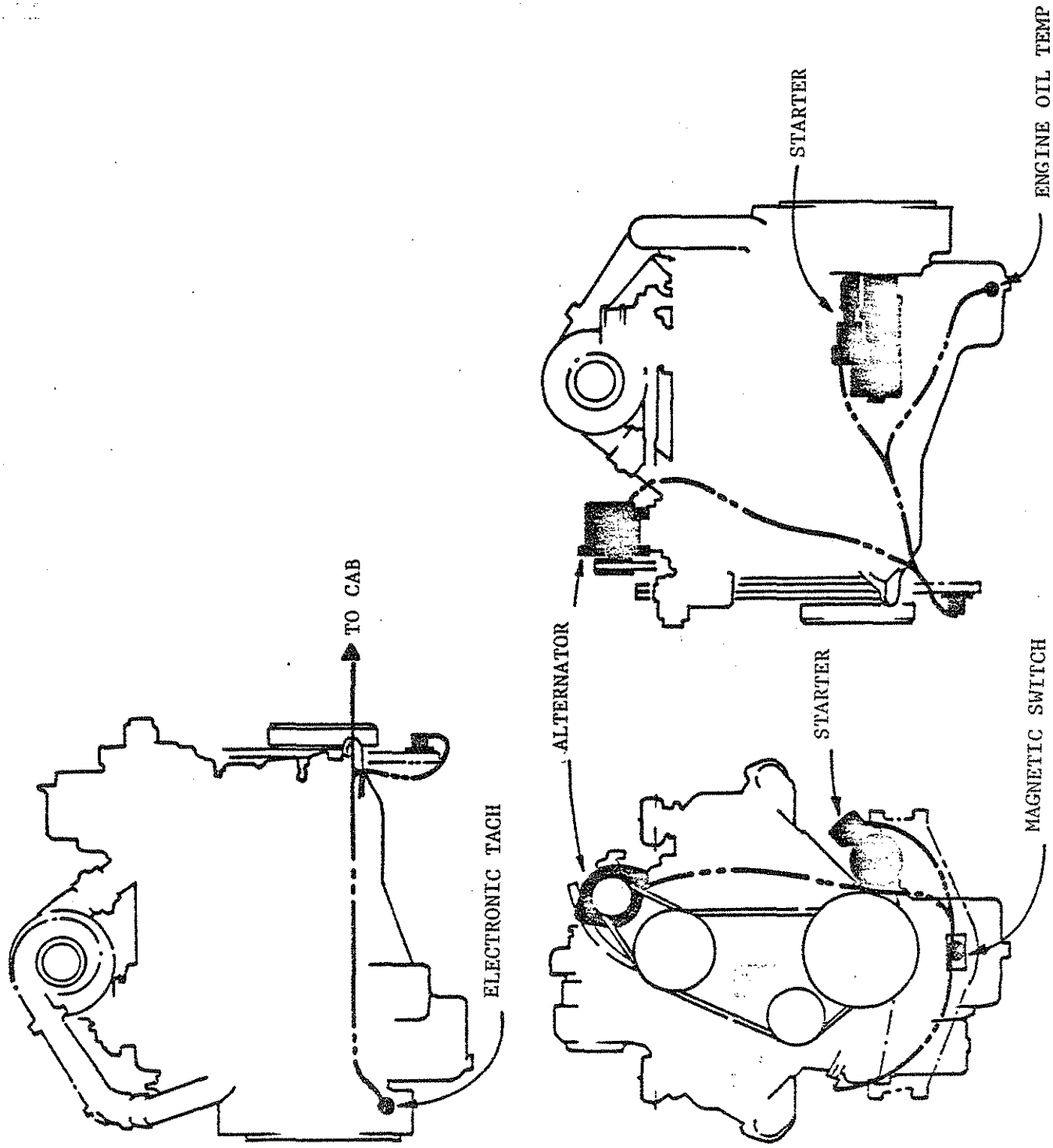
33-06114

Page 12

FRAME CONFIGURATION, CUMMINS VT-903 SERIES
12 VOLT SYSTEM

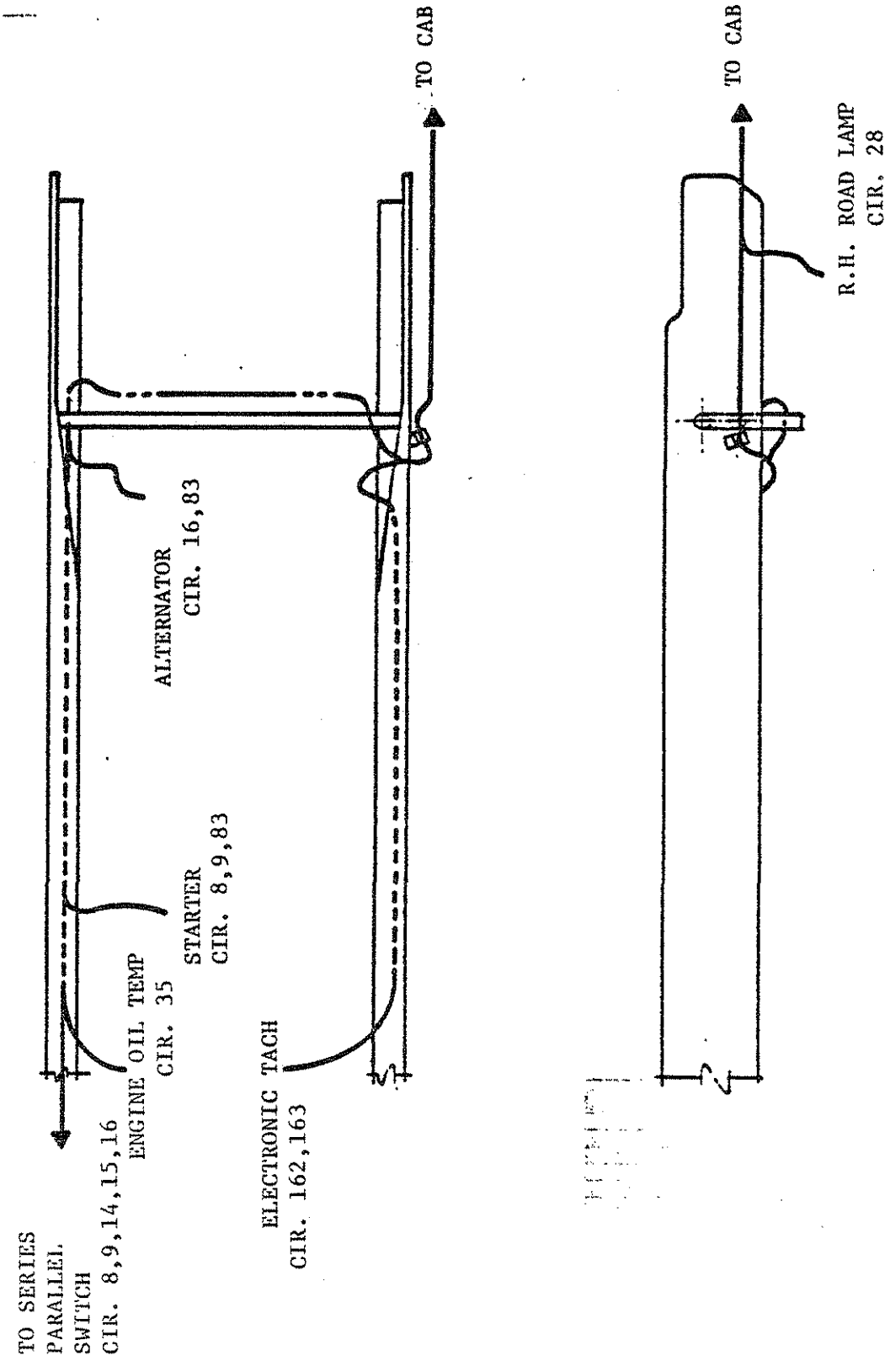


ENGINE, CUMMINS VT-903 SERIES
12 VOLT SYSTEM



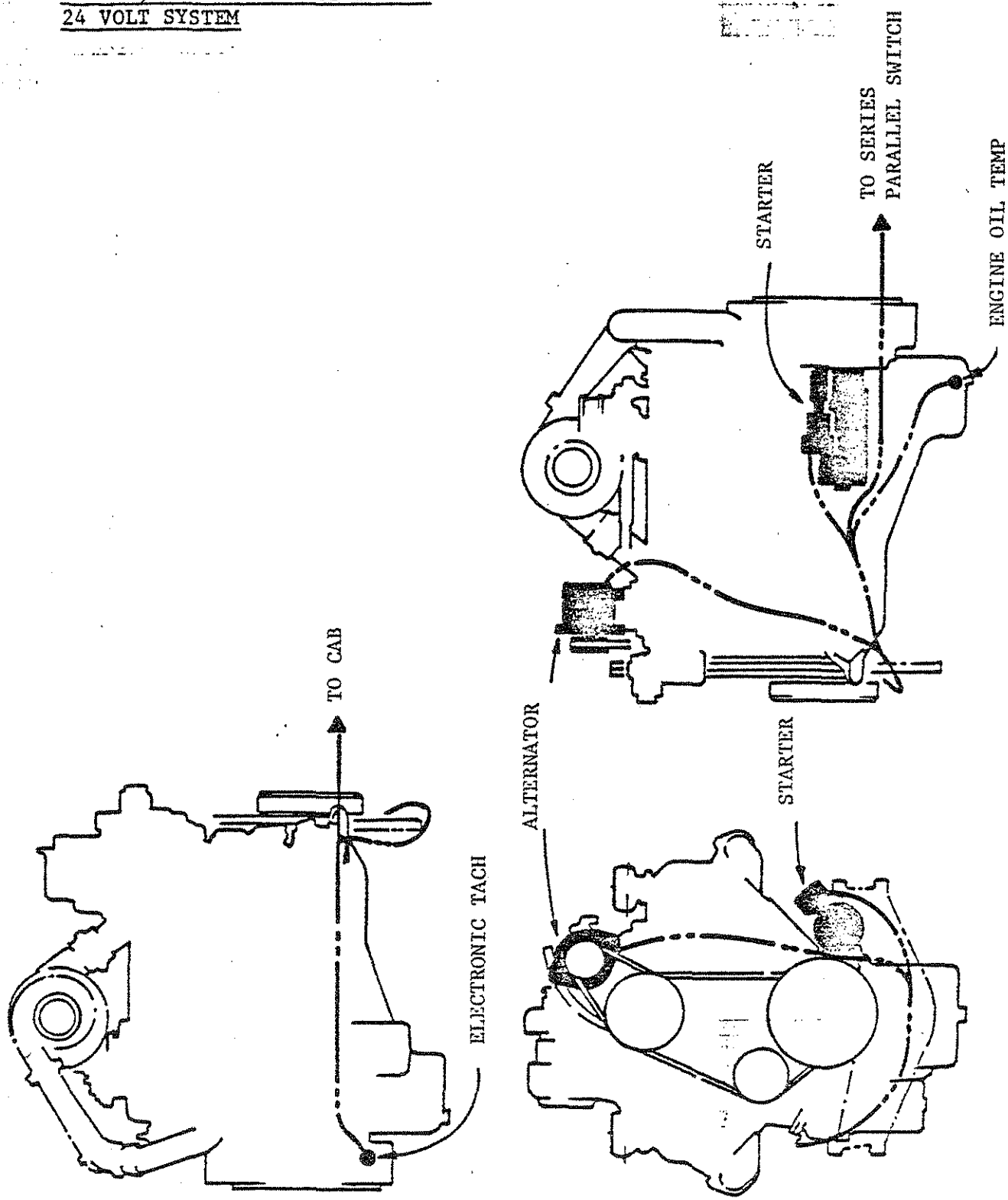
REVISED & RETYPED "A" CHG

FRAME CONFIGURATION, CUMMINS VT-903 SERIES
24 VOLT SYSTEM



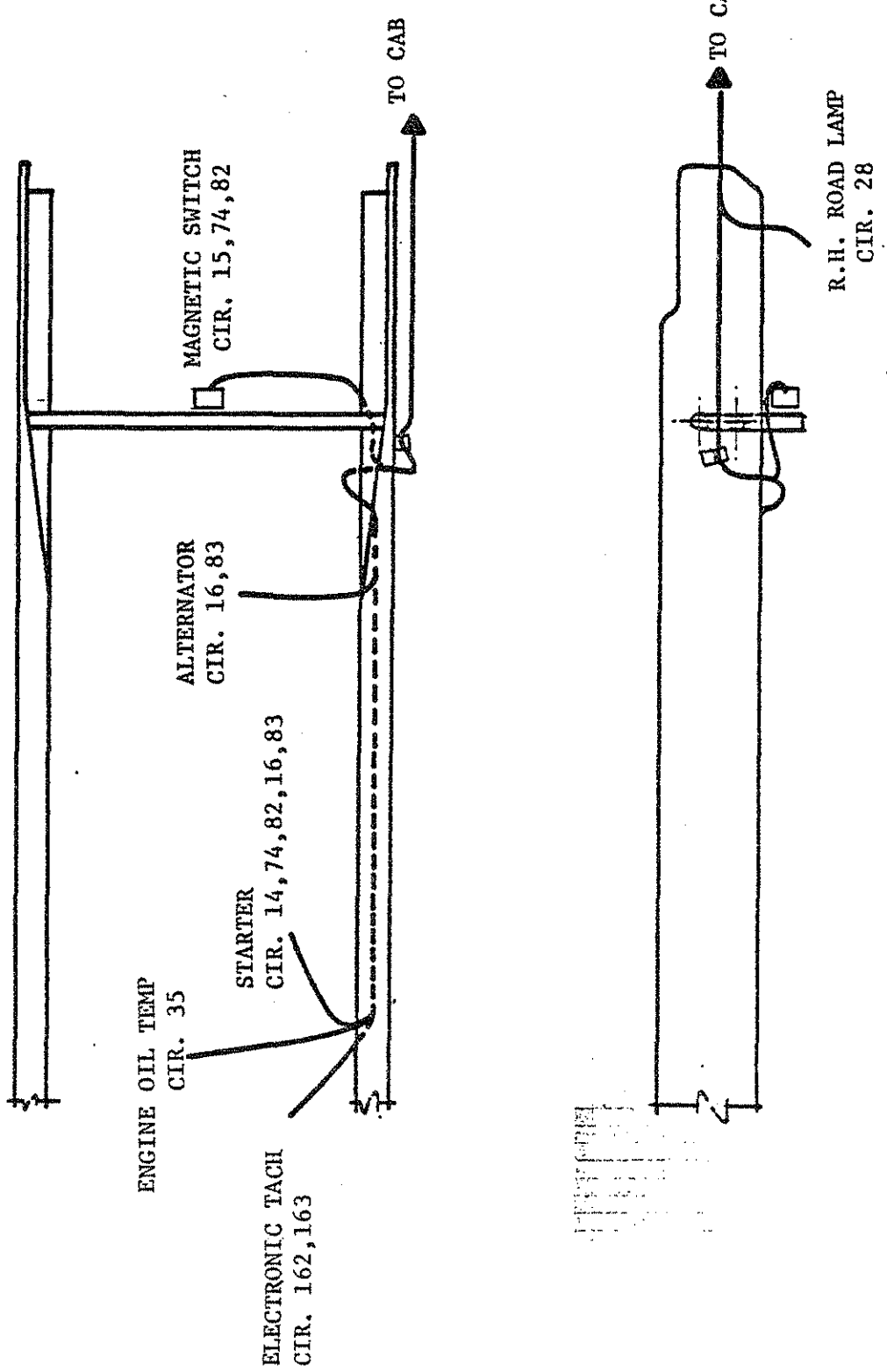
REVISED & RETYPED "C" CHG

ENGINE, CUMMINS VT-903 SERIES
24 VOLT SYSTEM

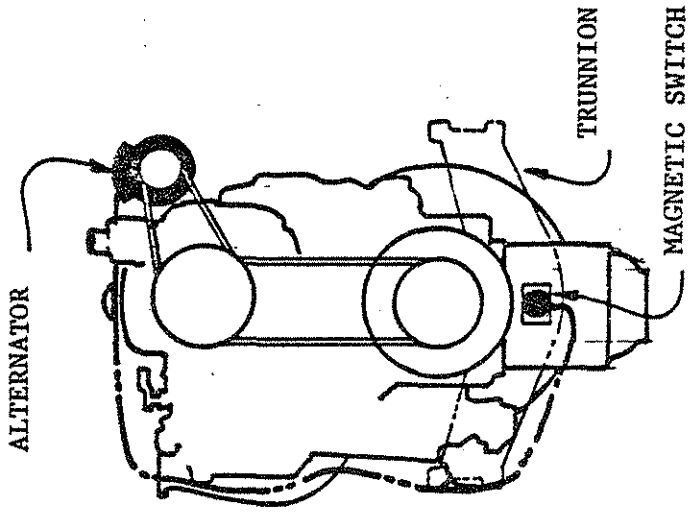


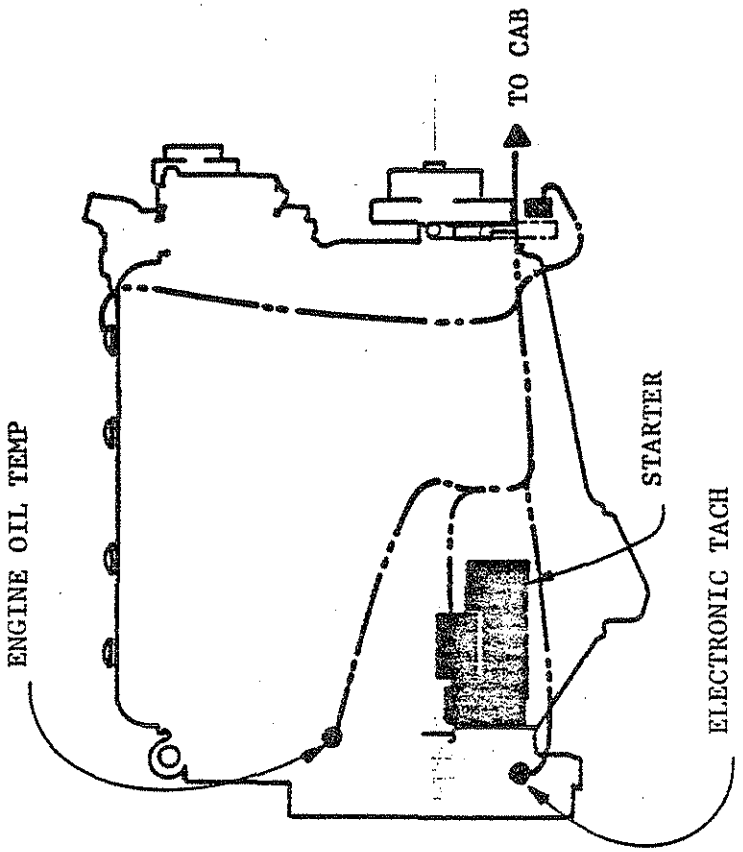
REVISED & RETYPED "A" CHG

FRAME CONFIGURATION, DDE 6171 SERIES
12- VOLT SYSTEM



ENGINE, DDE 6171
12 VOLT SYSTEM

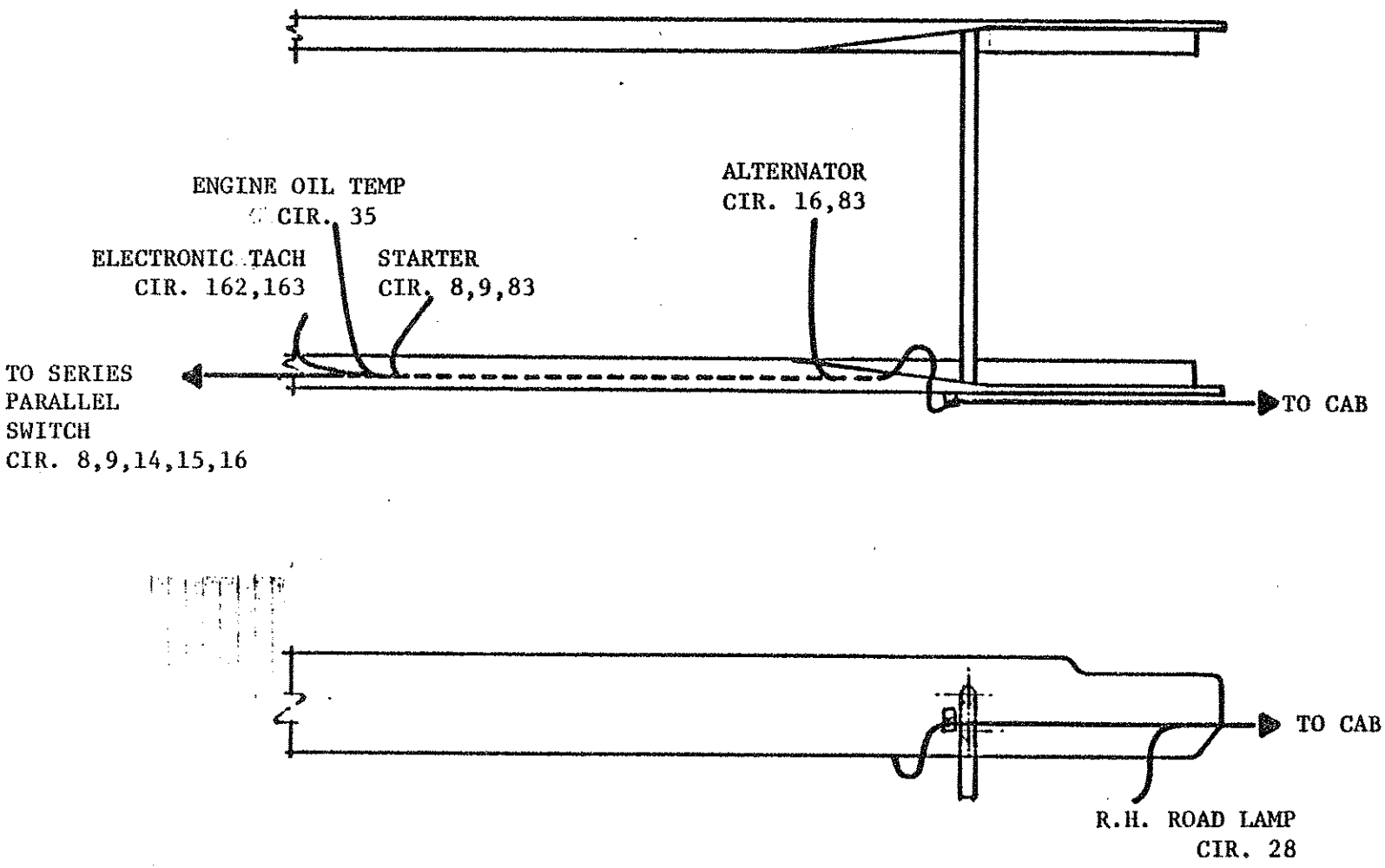




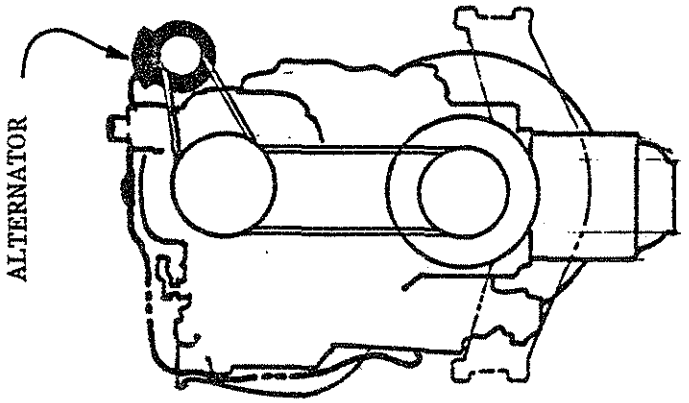
REVISED & RETYPED "A" CHG

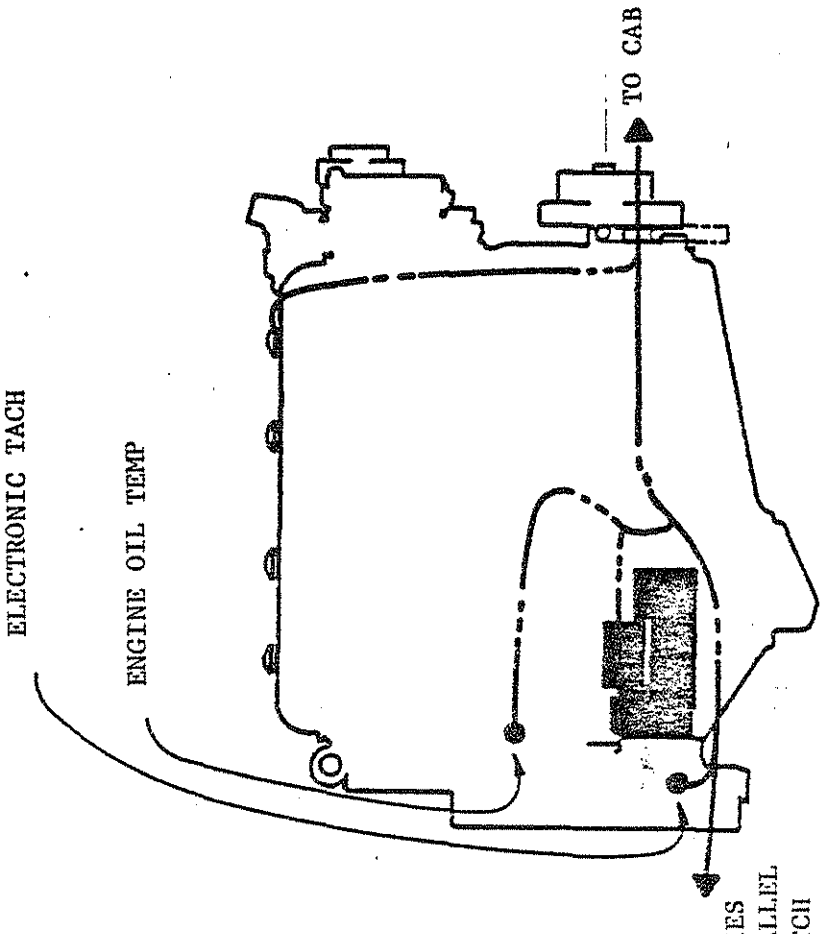
REVISED & RETYPED "B" CHG

FRAME CONFIGURATION, DDE 6171
24 VOLT SYSTEM



ENGINE, DDE 6171
24 VOLT SYSTEM





REVISED & RETYPED "A" CHG

REVISED & RETYPED "B" CHG

Compiled	N.RICHIE
Approved	E.TRAUB
Issued	6-18-73
Revised	11-13-74

Chg Ltr B

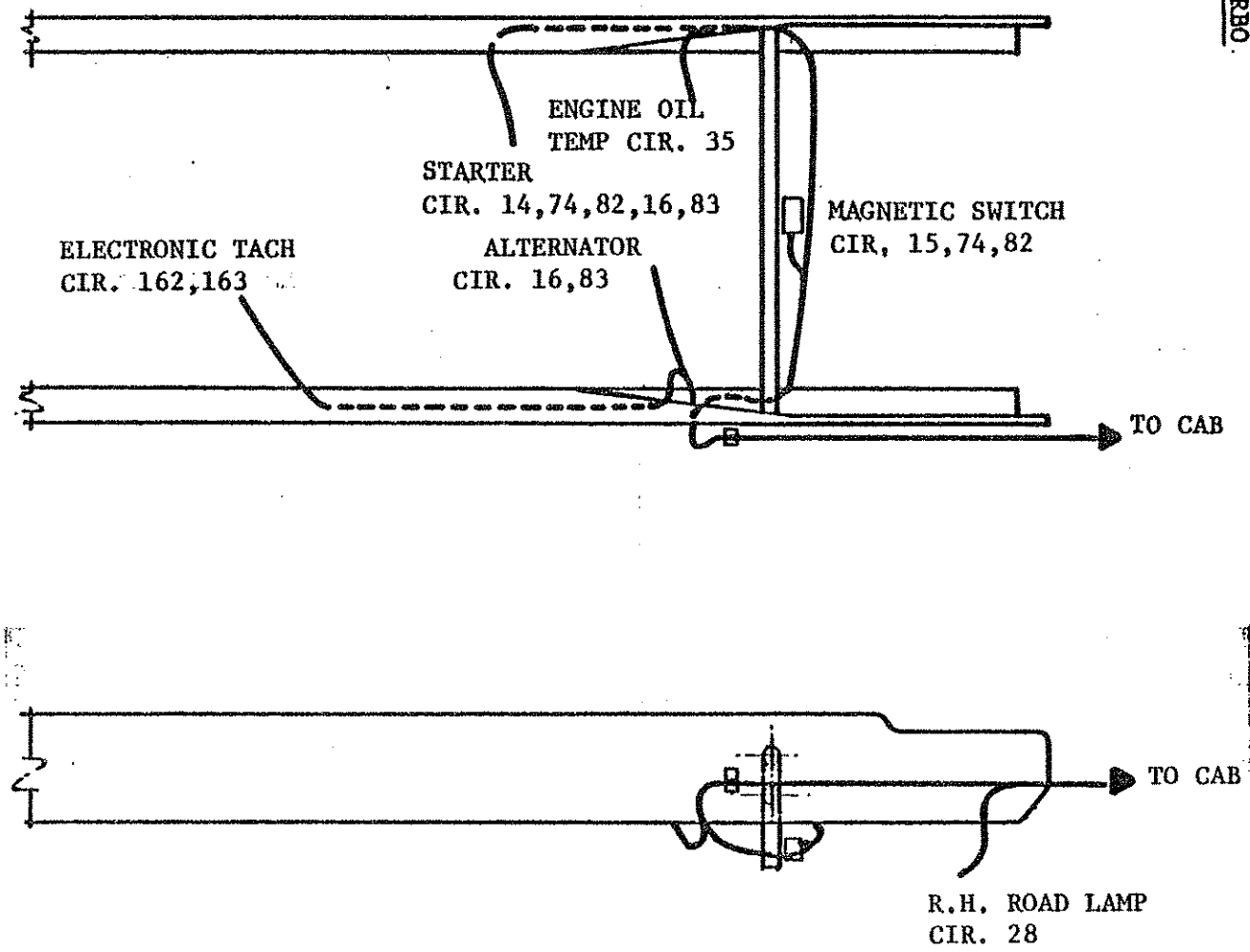
FREIGHTLINER CORPORATION
PORTLAND, OREGON

SHOP PRACTICE
ENGINE HARNESS INSTALLATION

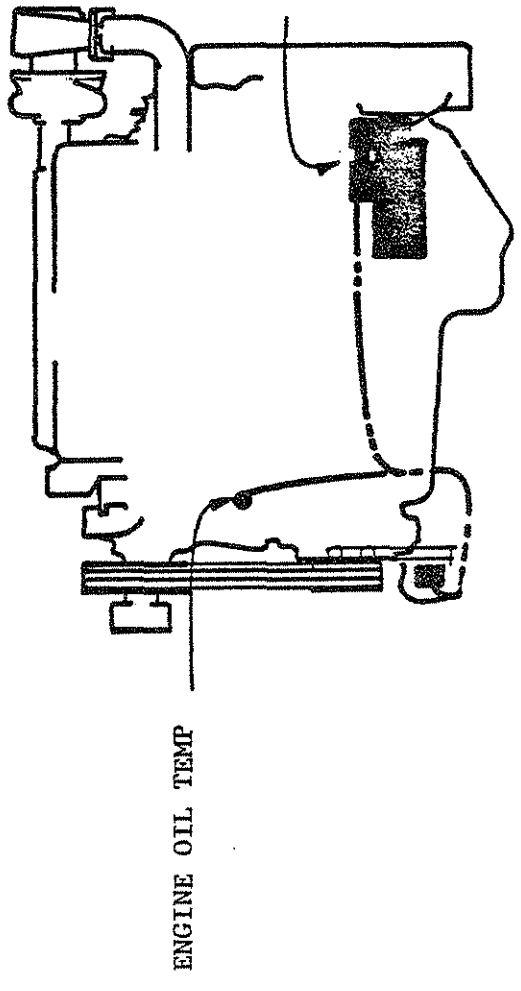
33-06114

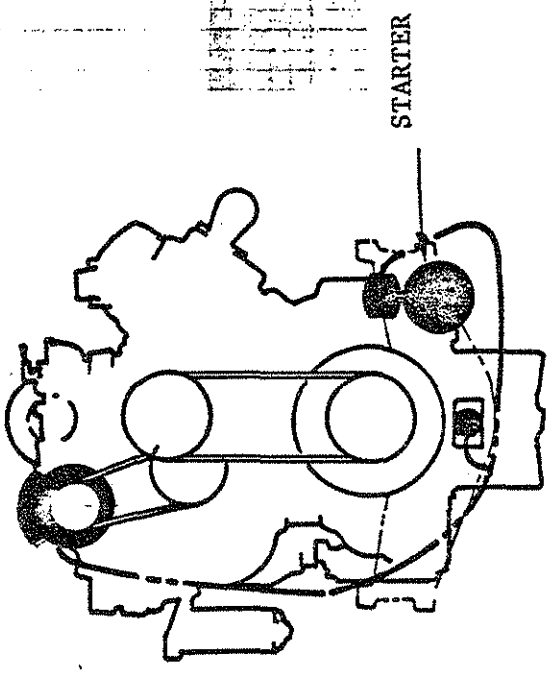
Page 20

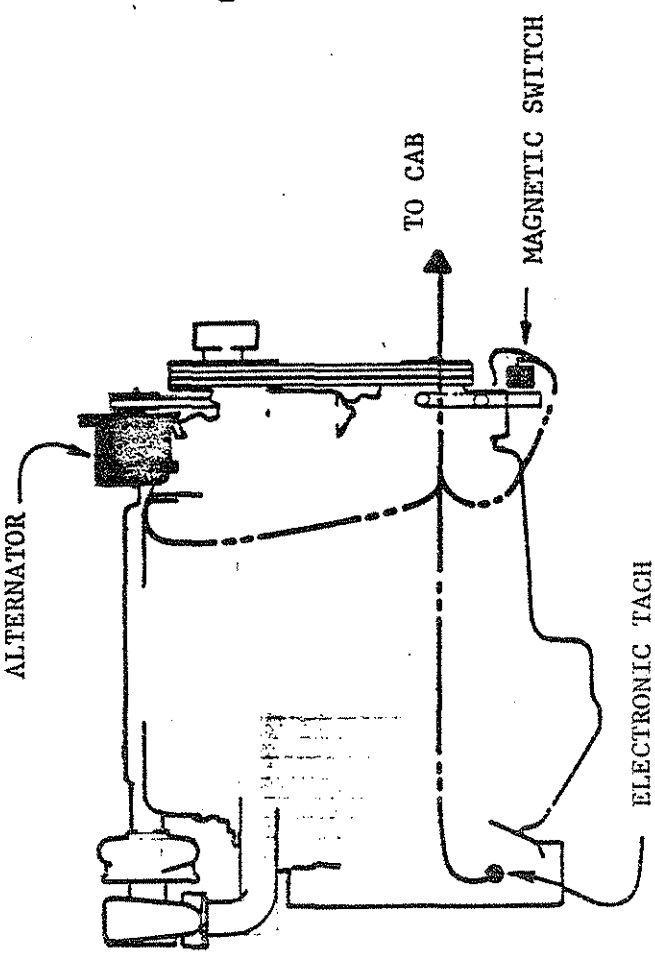
FRAME CONFIGURATION, DDE 8V-71T
12 VOLT SYSTEM
REAR MOUNT TURBO



ENGINE, DDE 8V-71T
12- VOLT SYSTEM
REAR MOUNT TURBO



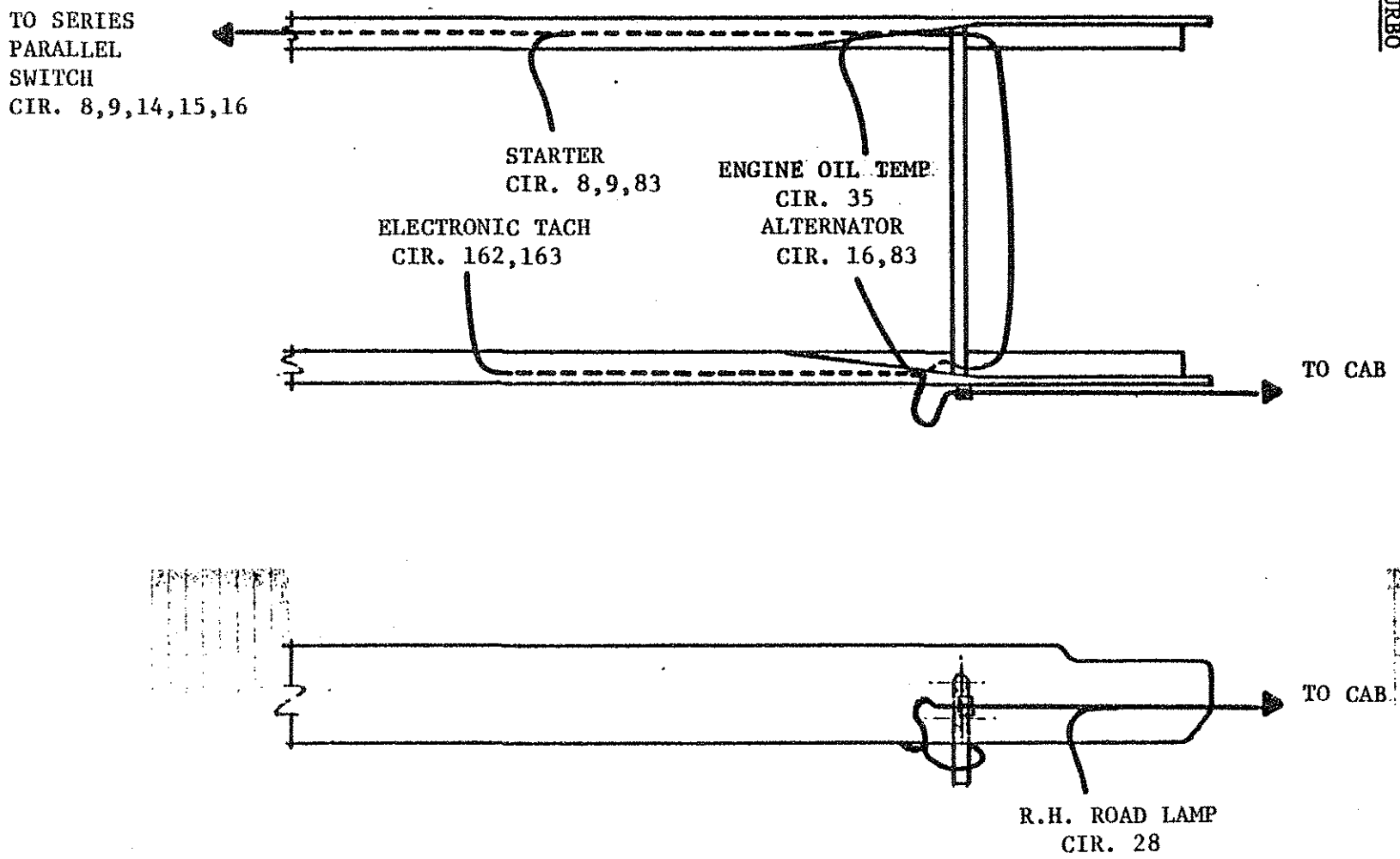




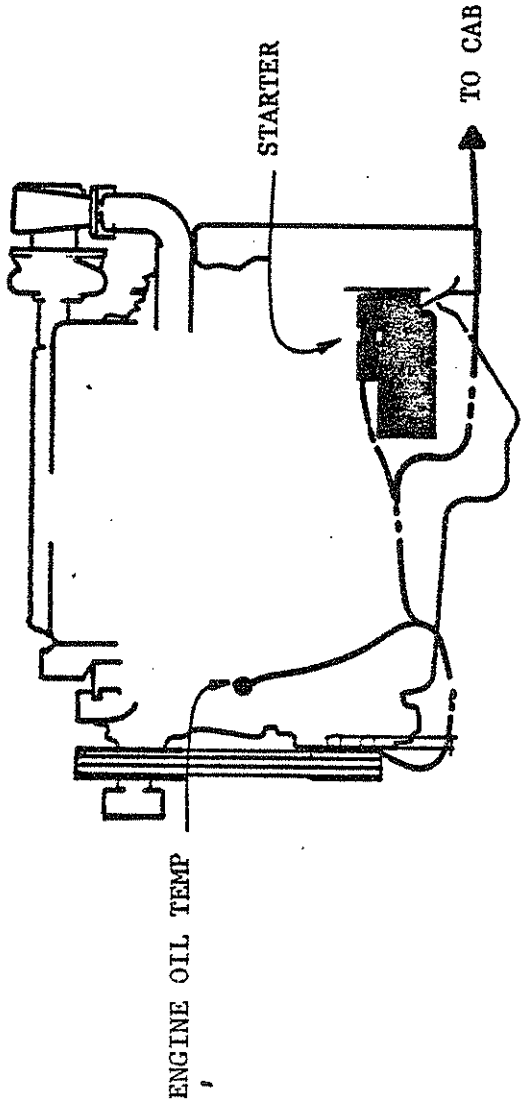
REVISED & RETYPED "A" CHG

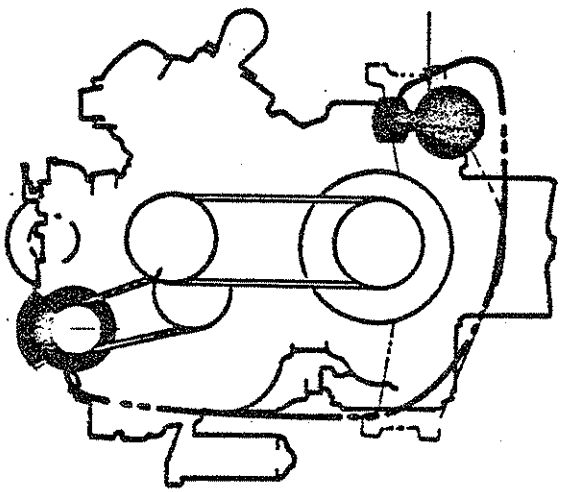
REVISED & RETYPED "B" CHG

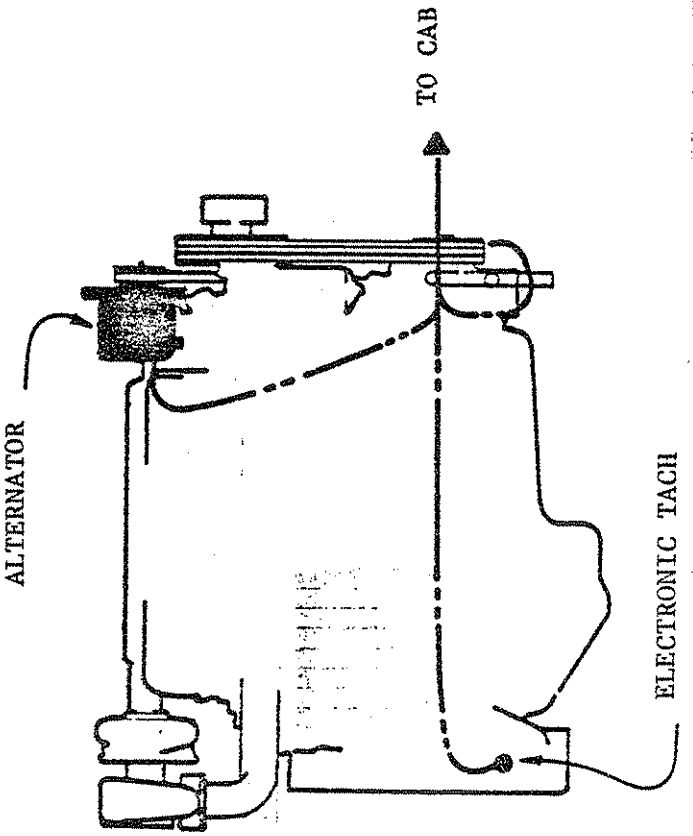
FRAME CONFIGURATION, DDE 8V-71T
24 VOLT SYSTEM
REAR MOUNT TURBO



ENGINE, DDE 8B-71T
24 VOLT SYSTEM
REAR MOUNT TURBO

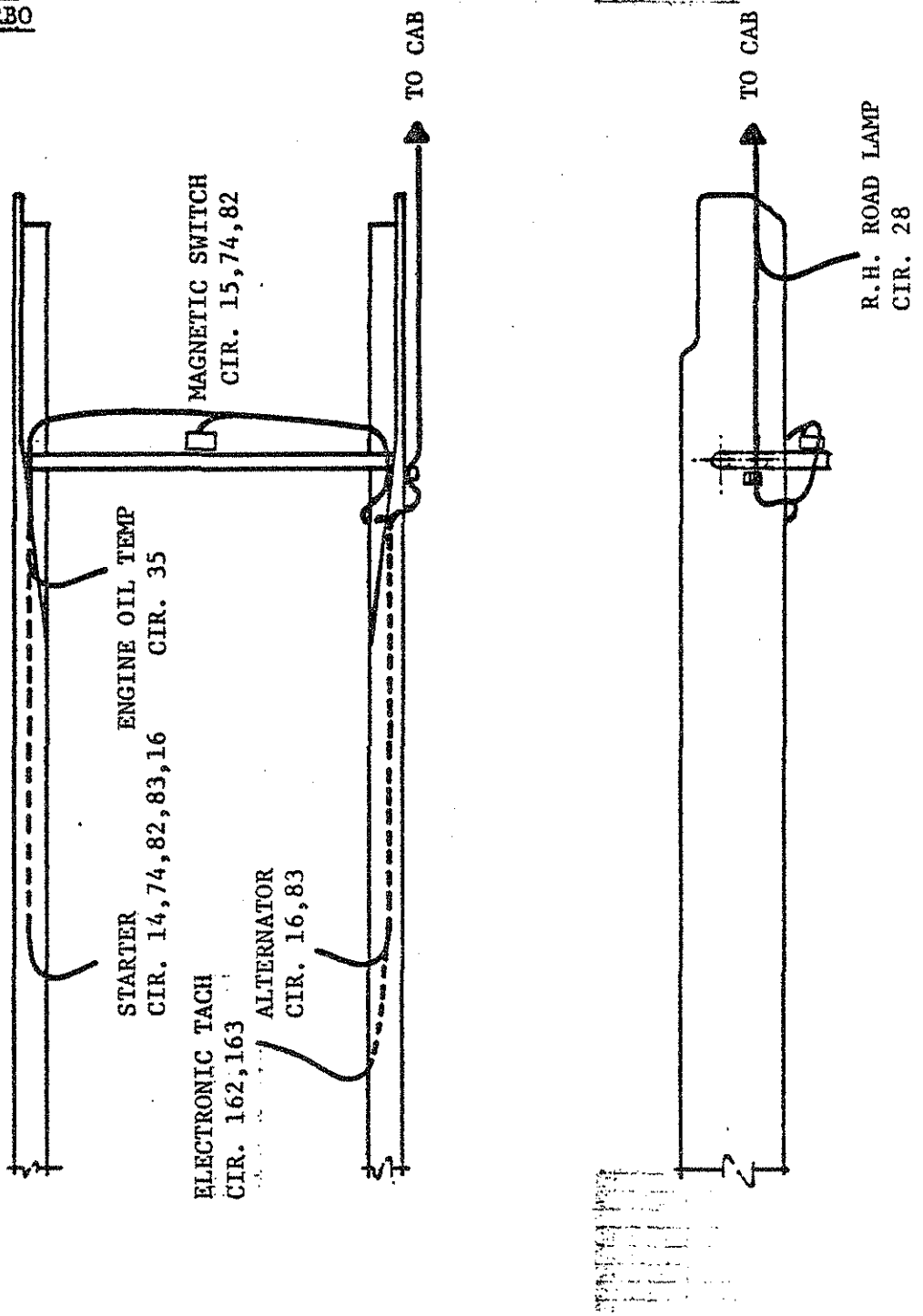






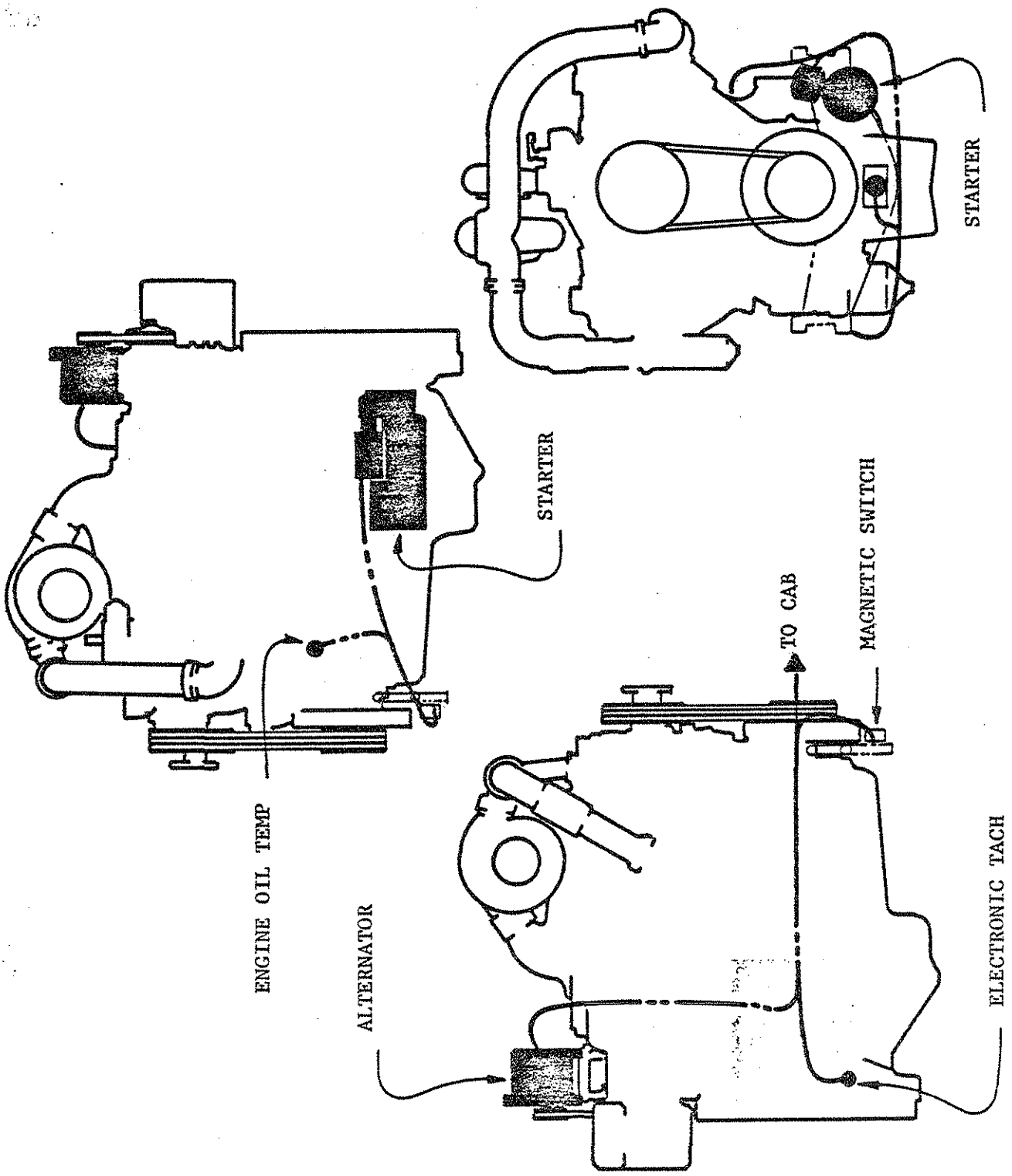
REVISED & RETYPED "A" CHG

FRAME CONFIGURATION, DDE 6V-71, 6V-71T & TA, 8V-71, 8V-71T & TA
12 VOLT SYSTEM
TOP MOUNT TURBO



REVISED & RETYPED "B" CHG

ENGINE, DDE 6V-71, 6V-71T & TA, 8V-71, 8V-71T & TA
12 VOLT SYSTEM
TOP MOUNT TURBO

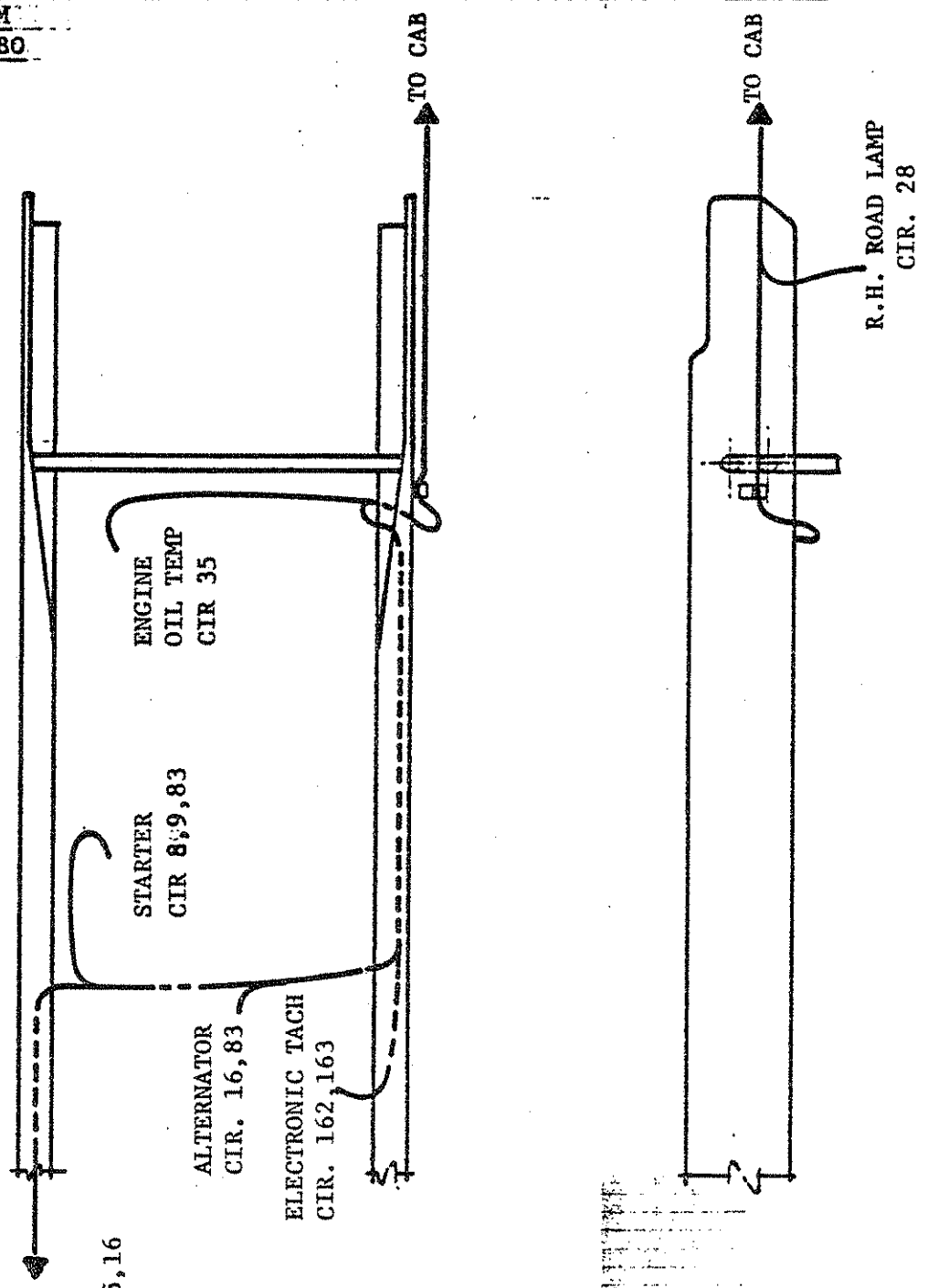


REVISED & RETYPED "A" CHG

Compiled	N.RITCHIE	SHOP PRACTICE ENGINE HARNESS INSTALLATION	33-06114
Approved	E.TRAUB		
Issued	6-18-73		
Revised	12-3-76	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 26

FRAME CONFIGURATION, DDE 6V-71, 6V-71T & TA, 8V-71, 8V-71T & TA, 6V-92, 6V-92T & TA, 8V-92, 8V-92T & TA, 12V-71

24 VOLT SYSTEM
TOP MOUNT TURBO



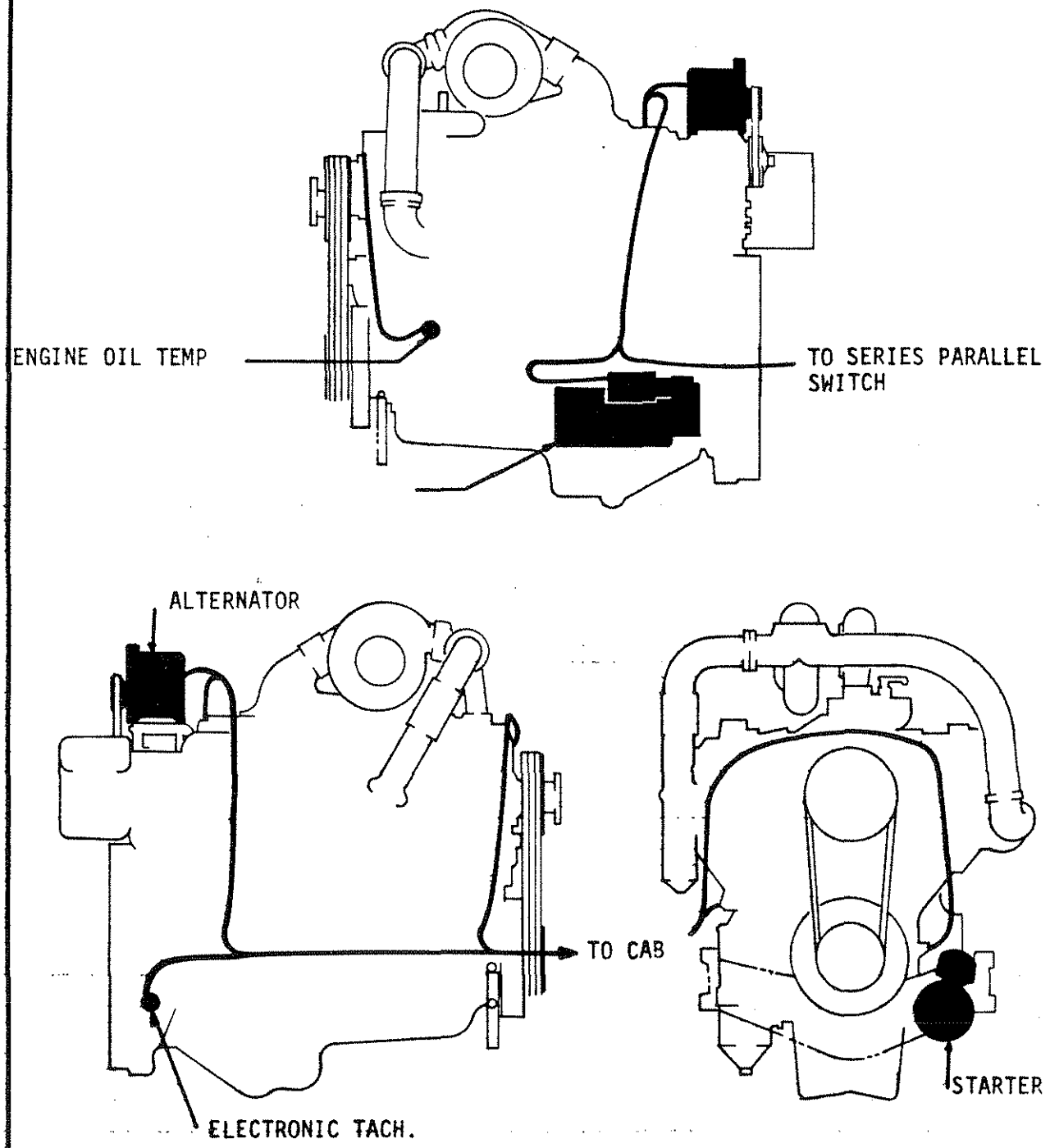
C

C

REVISED & RETYPED "B" CHG

B

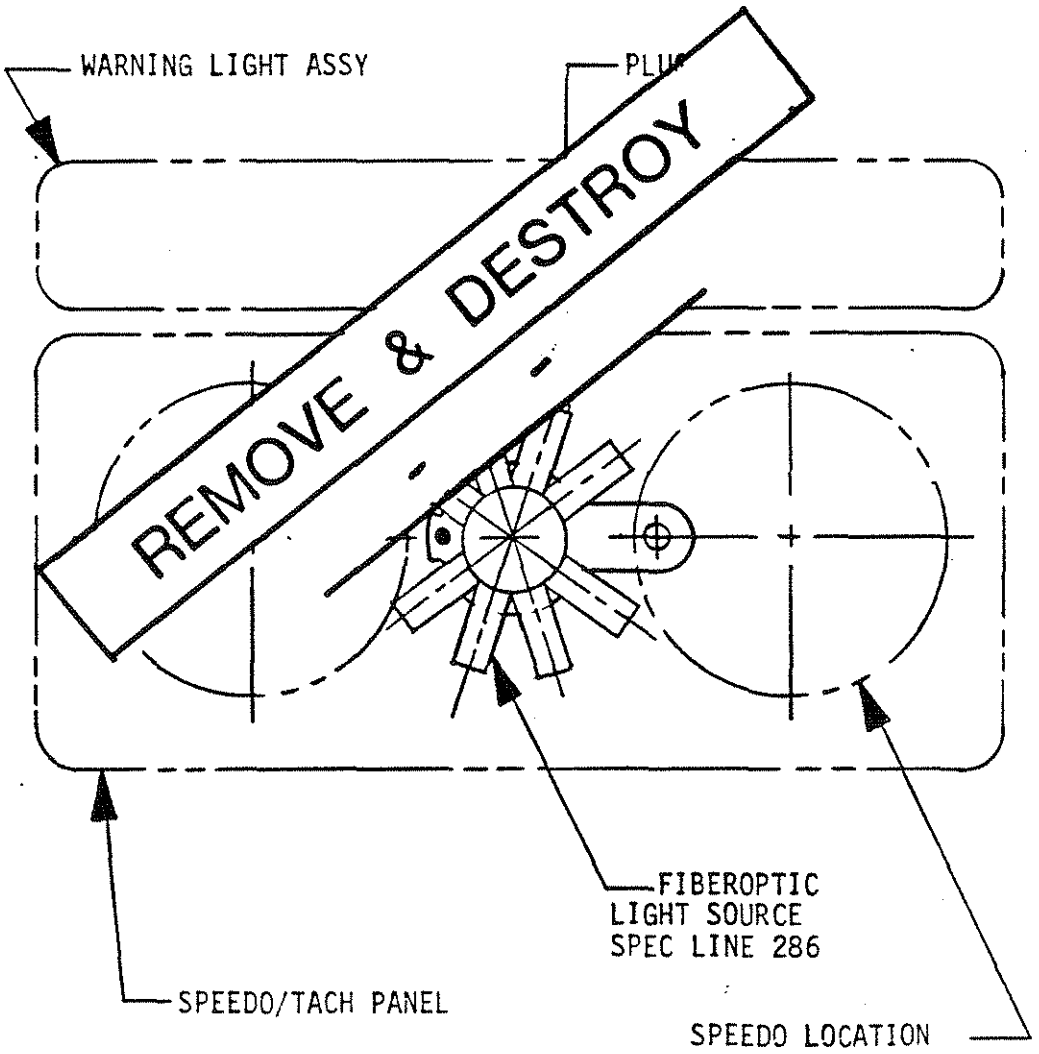
ENGINE DDE, 24 VOLT SYSTEM-TOP MOUNT TURBO[O]



Compiled	McIntosh	SHOP PRACTICE FIBEROPTIC LIGHT SOURCE TAPE INSTALLATION	33-06115
Approved			
Issued	6-9-84		
Revised	01/08/91	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	RA2024-56

DO NOT install the light tape assemblies in the upper two positions of light source (shown as plugged positions below).

The speedo/tach panel cannot be removed when tape assemblies are present.



COMPILED	ERK
APPRV	RJP
ISSUE DATE	01/10/79
REV DATE	01/25/91
CHG LTR	A

SHOP PRACTICE

TRACTOR/TRAILER ELECTRICAL TEST

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-06116

PA2024-56

THIS PROCEDURE TESTS FOR PROPER CHASSIS WIRING ON TRACTORS.

ELECTRIC CHECK:

1. CONNECT TRACTOR/TRILER TESTING DEVICE TO TRACTOR WITH 7-WAY ELECTRIC CABLE.

2. THE FOLLOWING SWITCHES ARE TO BE CHECKED:

   TURN SIGNALS
   TAIL LIGHTS
   STOP LIGHTS
   MARKER LIGHTS

   IN THE CAB OF THE TRACTOR, CHECK EACH ELECTRIC SWITCH (ONE AT A TIME). IF A PROBLEM ARISES, CHECK 7-WAY CABLE RECEPTACLE ON THE TRACTOR FOR PROPER WIRING.

Compiled	H.J.R.	SHOP PRACTICE VEHICLE CONTROLS LABELING	33-06117 PG 1 OF 1
Approved	Rollins		
Issued	11-6-72		
Revised	01/14/91	Chg Ltr C **FREIGHTLINER CORPORATION** PORTLAND, OREGON	PA2024-59

Since the labeling of vehicle controls comes under the jurisdiction of Federal Motor Vehicle Safety Standards, no deviations from specified labeling will be permitted without particular authorization in writing from Corporate Engineering. In all the below cases, the allowable word, symbols or abbreviations are explicitly specified.

The following controls are included in the above restriction:

1. Engine Start
2. Engine Stop (1)

C

3. Hand Throttle
4. Headlamps and Taillamps (4)
5. Vehicle Hazard Warning Signal (2)
6. Clearance Lamps (1) (3) (4)
7. Identification Lamps (1) (3)
8. Windshield Wiping System (1) (4)
9. Windshield Washing System (1) (4)
10. Windshield Defrosting and Defogging System (1) (4)

(1) Federal Motor Vehicle Safety Standard #101 also specifies; these controls will be illuminated when the headlight switch is activated. The intensity of light is to be variable from off to high.

(2) Omitted from the requirement on Freightliner due to its location on the steering column.

(3) When the clearance lamps and identification lamps are combined as on Freightliners, the labeling is to be as authorized for clearance lamps.

B

(4) FMVSS 101.80 requires these controls to have symbols only or words and symbols.

COMPILED	RJP	SHOP PRACTICE SOLDERING ELECTRICAL TERMINALS	SECTION NUMBER 33-06118
APPRV	ACL		
ISSUE DATE	06/07/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-011 FOR SOLDERING ELECTRICAL TERMINALS.

COMPILED	RJP
APPRV	ACL
ISSUE DATE	06/07/85
REV DATE	03/08/91
CHG LTR	C

SHOP PRACTICE

SOLDERED ELECTRICAL TERMINALS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

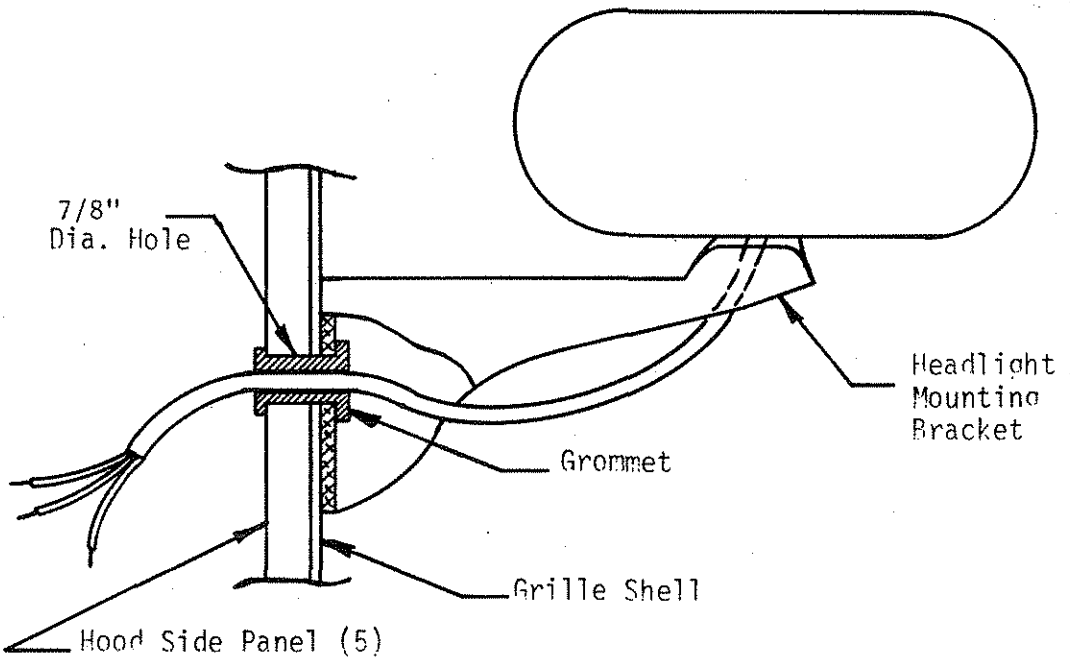
SECTION NUMBER
33-06118

PA2024-70

1. ALL TERMINALS WITHOUT CONNECTOR BODIES SHALL BE PROTECTED WITH HEAT SHRINK TUBING AS FOLLOWS:
   A. 48-02461-#: TERMINALS LOCATED INTERIOR OF CAB.
   B. 48-25005-#: TERMINALS LOCATED EXTERIOR OF CAB.
2. LEAD PREPARATION
   A. INSTALLATION STRIP LENGTHS ARE A FUNCTION OF THE WIRE SIZE AND THE TYPE OF TERMINAL BEING APPLIED. THEREFORE, STRIP LENGTHS WILL DEPEND ON THE TERMINAL MANUFACTURER'S SPECIFICATIONS.
   B. FINGER CONTACT WITH THE WIRE STRANDS MUST BE AVOIDED. IF ACCIDENTAL FINGER CONTACT IS MADE, THE WIRE STRANDS MUST BE CLEANED WITH AN APPROVED FLUX PRIOR TO FURTHER PROCESSING.
3. ACCEPTABLE CABLE PREPARATION CONDITIONS.
   A. REFER TO 49-00052, TABLE#1.
4. FLUX REQUIREMENTS.
   A. ALL FLUXES USED IN THE SOLDERING OR CLEANING OPERATIONS SHALL BE AS SPECIFIED ON DRAWING 48-02468.
5. SOLDER REQUIREMENTS.
   A. ALL SOLDER USED SHALL BE AS SPECIFIED ON DRAWINGS 48-02467 AND 48-02469.
6. TERMINAL DIP AND RESISTANCE SOLDERING.
   A. TERMINAL SOLDERING MUST CONFORM WITH REQUIREMENTS SPECIFIED IN FREIGHTLINER ENGINEERING STANDARD 49-00052.

Compiled	J. JUNOR	SHOP PRACTICE HEADLIGHT WIRE GROMMET, CONV.	33-06119
Approved	DRS		
Issued	11-21-79		
Revised	12-19-86	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	

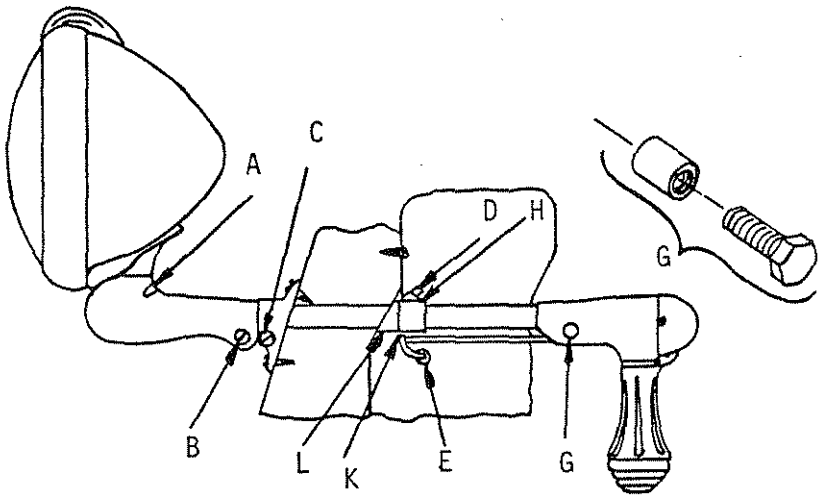
INSTALLATION PROCEDURE



A. Hole must be transfer drilled to 7/8 inches after installation of headlight mounting bracket.

B. Install grommet from outside of hood, this prevents the grommet from being pulled out when installing wire.

Compiled	F. Freer	SHOP PRACTICE SPOTLIGHT INSTALLATION	33-06120
Approved	D Lautzenhiser		
Issued	7-20-79		
Revised	9-12-79	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1



1. Cut out template and tape in specified location, or use metal template (UMC 52L or 52R) over template to check for proper fit.

2. Center punch through template, remove template and drill or punch 1/8" holes for self-tapping screws.

3. Mount bracket and rubber gasket in place and tighten screws securely.

4. Insert drill bushing found in each bracket kit into bracket and tighten bracket clamping screw (C).

5. Using drill bushing as a guide, drill a ½" diameter hole through outer layers of vehicle body. KEEP DRILL LEVEL AND IN PROPER ALIGHTMENT!

6. Loosen bracket clamping screw (C), remove and discard drill bushing and clean up burrs around drilled hole.

7. Tighten friction screw (B). Loosen wedge bolt (G) (THE WEDGE NEED NOT BE REMOVED) and slide off the handle and housing assembly.

8. Insert shaft through bracket until face of head housing and face of bracket are touching. The floating bushing on the spotlight shaft must seat itself within the counter bored recess in the bracket. Tighten clamping screw (C).

9. Place on shaft extending inside the vehicle the components of the inside bracket kit (UMC 3) - rubber bushing (L), wire clip (K), and locking collar (H) in that order. NOTE: Inside bracket kit #3 furnished for trucks includes an arm which fits inside special locking collar. Arm must be attached to inside of cab or post with self-tapping screw furnished for extra support.

10. Align wedge in handle to receive shaft and replace handle assembly making certain that the key on the I.D. of the handle housing gear lines up with the slot in the end of the inside tube. This can be done by putting a slight forward pressure on the handle housing and rotating the plastic

10. continued . . .

handle slowly until the key slips into the slot. Do not force or drive the handle onto the shaft. This could cause shorting. With the spotlight head upright, grasp the handle housing and rotate allowing the plastic handle to turn freely until the handle is in the desired operating position. (NOTE: If one of the stops is hit before reaching the desired handle position, it will be necessary to loosen the head housing clamping screw (B) and bracket clamping screws (C & D) in order to rotate the handle assembly further.) (CAUTION: Whenever head housing screw (B) is loosened, care must be taken that the head housing remains fully seated on the outer tubing. If allowed to back off, proper pressure between switch and shaft contacts might not be made causing overheating and/or shorting of spotlight switch.) Slight pressure is required against handle assembly to make certain the handle if fully seated and held in position until wedge bolt is tightened.

COMPILED	YOUNG	SHOP PRACTICE	SECTION NUMBER
APPRV	DJL		33-06125
ISSUE DATE	01/11/84	WIRE SIZING GUIDELINES	
REV DATE	07/29/96		PAGE 1 OF 1
CHG LTR	F	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-012 FOR WIRE SIZING GUIDELINES.

COMPILED	YOUNG	SHOP PRACTICE WIRING SIZING GUIDLINES			33-06125
APPROVED	DJL				
ISSUED	01-11-84				
REVISED	12-16-86	CHG LTR E	FREIGHTLINER CORPORATION PORTLAND, OREGON	CADAM ORIGINAL	PG. 1 OF 1

PRESENT PRODUCTION USES 13 POSITIONS OF THE 18 POSITION CIRCUIT BREAKER ASSEMBLY, LEAVING FIVE POSITIONS FOR OPTIONAL CIRCUITS. AS OPTIONS ARE ADDED, A CIRCUIT BREAKER OF SUFFICIENT AMPERAGE SHOULD BE ADDED. TO ENSURE ADEQUATE CIRCUIT BREAKER PERFORMANCE (I.E., PROTECT THE WIRING), THE FOLLOWING GUIDELINES SHOULD BE MET FOR MINIMUM WIRE SIZE(REGARDLESS OF WIRE LENGTH):

A

5 AMP CIRCUIT BREAKER - #16 AWG
10 AMP CIRCUIT BREAKER - #16 AWG
15 AMP CIRCUIT BREAKER - #14 AWG
20 AMP CIRCUIT BREAKER - #12 AWG
25 AMP CIRCUIT BREAKER - #12 AWG
30 AMP CIRCUIT BREAKER - #10 AWG

C IF THE NUMBER OF OPTIONS EXCEED THE THE ADDITIONAL CIRCUIT BREAKER POSITIONS, "GANGING" OF CIRCUITS IS PERMISSIBLE UP TO A MAXIMUM OF FIVE CIRCUITS PROVIDING THAT THE CIRCUIT BREAKER IS OF SUFFICIENT RATING TO HANDLE THE COMBINED AMP LOADS OF ALL THE CIRCUITS AND THE WIRE SIZES MEET THE ABOVE GUIDELINES.

B THE CIRCUIT BREAKER AMP RATING DICTATES THE SIZE OF WIRE (FROM THE ABOVE GUIDELINES). ALL WIRES DOWNSTREAM FROM THE CIRCUIT BREAKER MUST BE THAT SIZE (OR LARGER) NO MATTER HOW SMALL THE CURRENT DRAW OF THE COMPONENT.

D EXCEPTIONS:
A) 16 GAUGE WIRE CAN BE USED DOWNSTREAM OF THE RELAY COILS AND THE ELECTRONIC RHEOSTAT.
B) 14 GAUGE WIRE CAN BE USED DOWNSTREAM OF THE TURN SIGNAL FLASHER.

THE MAXIMUM ALLOWABLE LENGTH FOR A GIVEN WIRE SIZE AT ITS MAXIMUM AMPERAGE (FROM THE ABOVE GUIDELINES) IS 25 FEET, BEFORE A VOLTAGE DROP OF 1/2 VOLT IS REACHED (12 VOLT SYSTEM).

E CIRCUIT BREAKER LOCATION ALONG THE BUS BAR SHOULD HAVE THE HIGHER RATED BREAKERS(20 AMPS AND UP) INTERSPERSED BETWEEN LOWER RATED BREAKERS(15 AMPS AND LESS). LOWER RATED BREAKERS CAN BE LOCATED WITHOUT RESTRICTION.

COMPILED	DWP	SHOP PRACTICE ELECTRICAL TERMINAL PROTECTION COMPONENTS OUTSIDE THE CAB	SECTION NUMBER 33-06126
APPRV	NER		
ISSUE DATE	10/30/87		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	K		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-013 FOR ELECTRICAL TERMINAL PROTECTION.

COMPILED	DWP
APPRV	NER
ISSUE DATE	10/30/87
REV DATE	05/11/95
CHG LTR	J

SHOP PRACTICE

ELECTRIC TERMINAL PROTECTION COMPONENTS OUTSIDE THE CAB

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-06126
PAGE 1 OF 1
PD0031-01

MANY ELECTRICAL COMPONENTS ARE MOUNTED OUTSIDE THE CAB IN AREAS THAT ARE SUBJECTED TO HARSH WEATHER AND/OR ROAD SPRAY. SOME OF THESE COMPONENTS ALSO HAVE EXPOSED METAL ELECTRICAL TERMINALS WHICH RESULT IN THE CORROSION OF THE CONNECTION.

USE DIELECTRIC SPRAY SEALANT ON ALL EXPOSED ELECTRICAL TERMINALS AND USE DIELECTRIC GREASE ON ALL COVERED TERMINALS.

COMPONENTS THAT REQUIRE PROTECTION SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING:

METHOD OF PROTECTION	COMPONENT
48-02439-000 PUMPABLE DIELECTRIC GREASE	TAIL LAMP JUNCTION BOX (EXCEPT SEALED METRI-PACK CONNECTORS) HOOD HARNESS JUNCTION BOX SPEEDO MAG PICK-UP BOOT TACH MAG PICK-UP BOOT RECEIVER-DRYER LOW PRESSURE SWITCH BOOT 7-WAY RECEPTACLE BOOT ENGINE HEATER RECEPTACLE BOOT HOOD HEADLAMP/MARKERLAMP CONNECTION ELECTRIC HORN ENGINE BRAKE SOLENOIDS & HEAD ENGINE BRAKE THROTTLE SWITCH ENGINE/CHASSIS BULKHEAD CONNECTORS (1) BATTERY TERMINALS (2)
RED ENAMEL DIELECTRIC SPRAY (MMM1602 IVI-SPRAY SEALER, RED ELECTRIC GRADE) (SPRAY-ON B-6-665)	FUEL TANK SENDING UNIT BACK-UP LIGHT SWITCH KYSOR ALARM, FAN AND MULTI STATS STARTER ALTERNATOR MAGNETIC SWITCH SERIES-PARALLEL SWITCH WATER TEMPERATURE SENDING UNIT HIGH WATER TEMPERATURE SWITCH LOW OIL PRESSURE SWITCH OIL TEMPERATURE SENDING UNITS (ENGINE, TRANSMISSION & AXLES) ELECTRIC WIPER MOTORS ELECTRIC WASHER PUMP WIPER DELAYED SOLENOID ENGINE FAN SOLENOID LICENSE PLATE LAMP (INDIVIDUAL) CAB & SLEEPER GROUND WIRES STARTER GROUND CABLE BOLT & STUD GROUND CONNECTIONS (OUTSIDE THE CAB) CUT-OFF SWITCH CONNECTIONS

(1) PACK THE NON-WIRE INSERTION SIDE OF ENGINE/CHASSIS HARNESS BULKHEAD CONNECTORS (WHEN FIREWALL MOUNTED). THE GREASE MUST VISIBLY EXUDE OUT WIRE INSERTION SIDE, COMPLETELY ENCAPSULATING ALL TERMINALS TO PREVENT MOISTURE CONTAMINATION.

(2) APPLY LIBERALLY TO BATTERY TERMINAL PADS, THEN INSTALL INTER-CONNECTORS.

COMPILED	PKG
APPRV	MJC
ISSUE DATE	04/09/93
REV DATE	07/29/96
CHG LTR	B

SHOP PRACTICE

FRAME GROUND WELD STUD INSTALLATION

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-06127

PAGE
1 OF 1

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0006-014 FOR FRAME GROUND WELD STUD INSTALLATION.

COMPILED	PKG	SHOP PRACTICE FRAME GROUND WELD STUD INSTALLATION	SECTION NUMBER **33-06127**
APPRV	MJC		
ISSUE DATE	04/09/93		PAGE 1 OF 4
REV DATE	06/02/93	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2101-02

INTRODUCTION:

WELD STUDS SHALL BE APPLIED USING AUTOMATICALLY TIMED STUD WELDING EQUIPMENT, CONNECTED TO A SUITABLE SOURCE OF DIRECT CURRENT STRAIGHT POLARITY POWER.

WARNING:

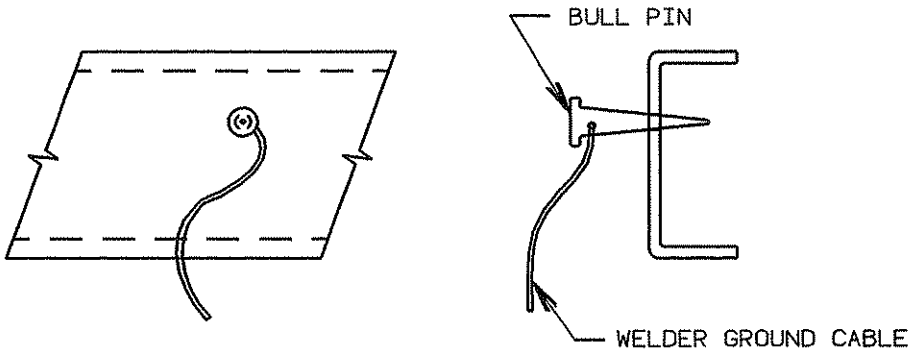
IF TWO OR MORE STUD WELDING GUNS ARE TO BE OPERATED FROM THE SAME POWER SOURCE, THEY MUST BE INTERLOCKED SO THAT ONLY ONE GUN CAN OPERATE AT A TIME.

GROUNDING:

THE STUD WELDER SHALL BE GROUNDED TO THE RAIL OF WHICH THE WELDING IS TO TAKE PLACE. A TAPERED BULL PIN SHALL BE DRILLED AND TAPPED, AND SECURELY FASTENED TO THE GROUND CABLE IN PLACE OF A C-CLAMP. THE PIN SHALL BE ATTACHED TO THE RAIL BY TAPPING IT INTO A PRE-PUNCHED HOLE IN THE RAIL. THE PIN SHALL REMAIN RIGID IN THE HOLE DURING THE WEDING OPERATION. THE TAPERED BULL PIN TESTED AT THE M.E. SHOP IS A "KLEIN 3256" BROAD HEAD BULL PIN WITH 1/4" TO 1-1/16" X 10" TAPER.

NOTE:

THE USE OF THE BULL PIN FOR GROUNDING REQUIRES THAT THE WELD OPERATION BE SET UP AS FAR UP LINE AS POSSIBLE TO ASSURE AN OPEN HOLE IN THE RAIL WILL BE AVAILABLE.



WELDING PREPARATION:

A CENTER PUNCH MARK WILL BE PROVIDED BY THE BEATTY AT EACH WELD STUD, LOCATION. IF THE PUNCH MARK CANNOT BE LOCATED OR IS INHIBITED BY RUST, PAINT, GREASE OR OTHER CONTAMINATES, A 1" DIAMETER AREA MUST BE CLEANED TO BARE METAL.

OGON ID=

WELDING EQUIPMENT:

WELDERS AT EACH PLANT ARE EQUIPPED WITH #1 GAUGE GROUND CABLE AND C-CLAMP. THE C-CLAMP IS TO BE REPLACED WITH A TAPERED BULL PIN AS DESCRIBED IN THE GROUNDING SECTION.
IN NO CASE SHALL THE TOTAL LENGTH OF WELD AND GROUND CABLE EXCEED 110 FT. IN NO CASE SHOULD AN ALTERNATE CABLE OF SMALLER GAUGE WIRE BE USED. FOR FURTHER INFORMATION ON THE WELDING UNIT, REFER TO THE "TRW NELSON INSTRUCTION/MAINTENANCE MANUAL".

THE CHART ON THE FRONT OF THE WELDER IS A REFERNCE STARTING POINT FOR A STUD WELD ON A HORIZONTAL PLATE. WHEN WELDING TO A VERTICAL PLATE THE TIME IS GENERALLY SHORTER AND THE CURRENT SLIGHTLY HIGHER.

FOLLOWING IS A LIST OF WELDERS BEING USED AT EACH PLANT, AND THE SETTINGS WHICH EACH OF THE WELDERS HAVE BEEN FOUND TO PRODUCE AN ACCEPTABLE WELD. AGAIN THESE ARE TO BE STARTING POINTS AND EACH UNIT MAY HAVE TO BE ADJUSTED PERIODICALLY DUE TO VARIATIONS IN SHOP POWER, GUN CONDITION, ETC.

LOCATION	WELDER	WELD-BASE	TIME	CURRENT
M.E. SHOP	TRW NELSON SER.4800 MODEL 100	7/16"DIA	.53 SEC.	750 AMPS
MT. HOLLY	TRW NELSON SER.4800 MODEL 100	7/16" DIA.	.33 SEC.	700 AMPS
ST. THOMAS	TRW NELSON SER.4800 MODEL 100	7/16" DIA.	.53 SEC.	750 AMPS
PORTLAND	TRW NELSON SER.4800 MODEL 100	7/16" DIA.	.38 SEC.	750 AMPS
CLEVELAND	TRW NELSON SER.5000 MODEL 200	7/16" DIA.	.40 SEC.	550 AMPS

ONCE THE OPTIMUM SETTINGS ARE DETERMINED FOR EACH MACHINE, USING A 7/16" WELD STUD, THE VALUES FOR TIME AND CURRENT WILL BE DISPLAYED ON THE WELDER AT EACH PLANT

COMPILED	PKG
APPRV	MJC
ISSUE DATE	04/09/93
REV DATE	06/02/93
CHG LTR	A

SHOP PRACTICE

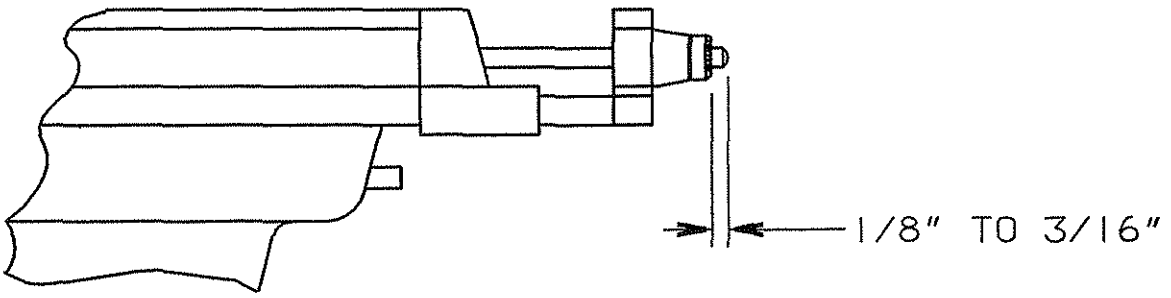
FRAME GROUND WELD STUD INSTALLATION

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-06127

PA2101-02

THE FOOT OF THE GUN MUST BE SET SO THE WELD STUD IS CENTERED IN THE FERRULE. THE LEGS MUST BE ADJUSTED SO THE WELD STUD EXTENDS 1/8" TO 3/16" BEYOND THE END OF THE FERRULE.



WELDING:

FERRULES SHALL BE KEPT DRY BEFORE AND DURING USE. WHILE IN OPERATION, THE WELDING GUN SHALL BE HELD PERPENDICULAR TO THE RAIL WEB, AND WITHOUT MOVEMENT RELATIVE TO THE RAIL, UNTIL ALL WELD METAL HAS SOLIDIFIED.

INSPECTION:

FOLLOWING EACH WELD, THE FERRULE SHALL BE REMOVED AND EACH WELD VISUALLY INSPECTED. THERE SHALL BE A SMOOTH, FULL, AND UNIFORM FILLET AROUND THE CIRCUMFERENCE OF THE WELD STUD. DUE TO GRAVITY, AN EXCESS OF MATERIAL MAY BE PRESENT ON THE LOWER SIDE OF THE STUD. THIS IS NORMAL FOR A VERTICAL WELD AND IS ACCEPTABLE.

ANY STUD WITH A WELD OF QUESTIONABLE QUALITY DUE TO EXCESS EXPULSION, SPLATTER, OR POROSITY, CREATING A NON-UNIFORM FILLET WELD, MUST BE REMOVED FROM THE RAIL AND REPLACED.

IF A WELD IS CHARACTERIZED AS ACCEPTABLE, WITH THE EXCEPTION OF A MINOR BREAK IN THE FILLET, A CRACK, OR A VOID, IT MAY BE TOUCHED UP AS DESCRIBED IN THE REPAIR SECTION.

IN THE CASE OF ANY QUESTIONABLE WELD THAT HAS BEEN REPLACED OR REPAIRED, THE WELDING EQUIPMENT SHOULD BE CHECKED AND ADJUSTED AS NECESSARY TO PROVIDE AN IMPROVED, ACCEPTABLE WELD.

A SERIES OF PHOTOGRAPHS, SUPPLIED BY MANUFACTURING, SHALL BE AVAILABLE NEAR THE GROUND STUD WELDING OPERATION AT EACH LOCATION. THESE PHOTOS ARE A GUIDE TO ILLUSTRATE CHARACTERISTICS OF ACCEPTABLE AND NON-ACCEPTABLE WELDS. ALSO SEE PAGE 4 FOR WELD PROFILES.

REPAIR PROCEDURE:

IF A WELD IS INSPECTED AND IS ACCEPTABLE EXCEPT FOR A MINOR BREAK OR VOID IN THE FILLET IT MAY BE REPAIRED BY STICK WELDING, FOLLOWED AGAIN BY INSPECTION. IF THE REPAIR PROCESS DOES NOT BRING THE WELD UP TO ACCEPTABLE STANDARDS, THE STUD MUST BE REMOVED AND A NEW STUD APPLIED.

DATE= 6/04/93 TIME=16.19 ACCESS=NONE
SESSION ID=

COMPILED	PKG	SHOP PRACTICE FRAME GROUND WELD STUD INSTALLATION	SECTION NUMBER **33-06127**
APPRV	MJC		PAGE 4 OF 4
ISSUE DATE	04/09/93	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2101-02
REV DATE	06/02/93		
CHG LTR	A		

OPERATOR TESTING:

1. AT INITIAL SETUP OR FOLLOWING EQUIPMENT REPAIR:

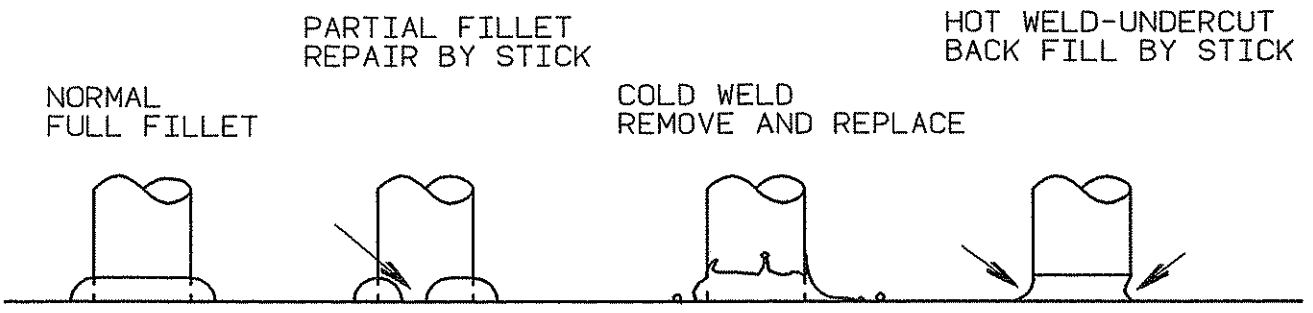
DESTRUCTIVE TESTING AS DESCRIBED BELOW WILL BE PERFORMED TO OBTAIN OPTIMUM MACHINE SETTINGS.

2 DAILY AT BEGINNING OF EACH SHIFT:

AT THE BEGINNING OF EACH SHIFT A MINIMUM OF ONE STUD WILL BE WELDED TO A TEST RAIL AND DESTRUCTIVLY TESTED AS DESCRIBED BELOW. (NOTE; THE TEST RAIL IS TO BE POSITIONED WITH THE WEB IN A VERTICAL POSITION.)

DESTRUCTIVE TESTING SHALL BE PERFOMED ON A SAMPLE PIECE OF FRAME RAIL AT EACH PLANT. THE RAIL SHALL BE POSITIONED WITH THE WEB VERTICAL, TO REPRESENT A PRODUCTION WELD PROCESS. A BEND TEST WILL CONSIST OF WELDING A STUD TO THE RAIL, PERFORMING A VISUAL CHECK, AND STRIKING THE STUD ON THE COLLAR UNTIL THE STUD IS BENT APPROXIMATELY 45 DEGREES FROM ORIGINAL POSITION. THE WELD SHALL REMAIN INTACT, WITH NO VISUAL SEPARATION FROM THE RAIL.
AT INITIAL EQUIPMENT SET UP, A MINIMUN OF 15 WELD STUDS SHALL BE TESTED TO ASSURE OPTIMUM SETTINGS AND CONSISTENT WELDS.
FOLLOWING INITIAL SET UP THE DESTRUCTIVE TEST IS TO BE PERFORMED DAILY AT THE BEGINNING OF EACH SHIFT USING AS MANY WELD STUDS AS NECESSARY TO PROOF THE EQUIPMENT AND OPERATION.

WELD STUD PROFILES



30N ID=

Compiled	MURRELL	SHOP PRACTICE ANTI-LOCK SYSTEM, FMVSS #121	33-06130
Approved			
Issued	2-17-75	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised	9-10-76		

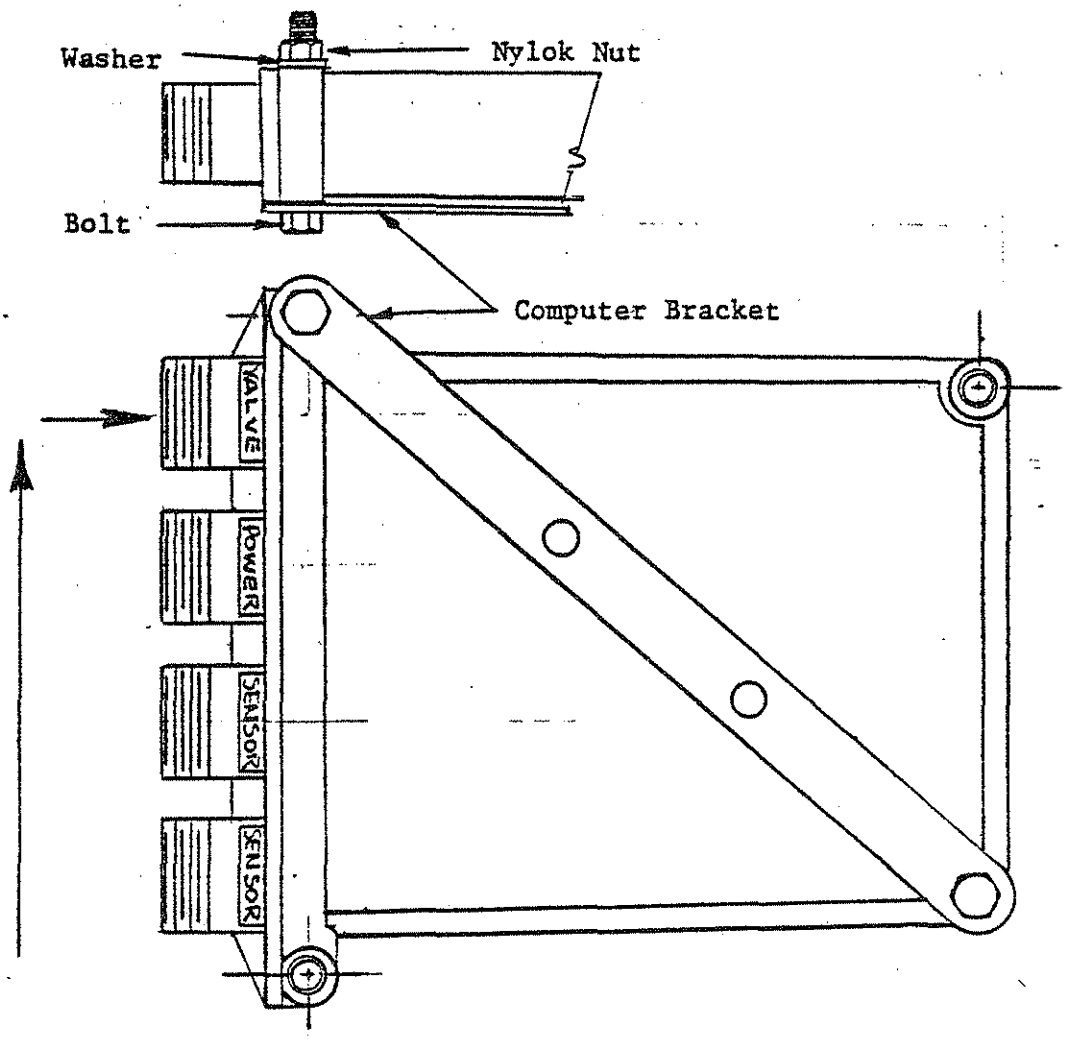
A. Wagner Computer Mounting

OBSOLETE - SAVE

1. When mounted in frame rail, valve terminal is to be up.

2. When mounted in rear crossmember, valve terminal is to be inboard on RH side and outboard on LH side.

B



B. COMPONENT IDENTIFICATION

Computor modules, failure warning modules & CRP relays (ROCKWELL ONLY) are to be serial numbered as shown on D06-11685. Duplicate decals to be placed on form QC-56.

B C. COMPUTER MOUNTING BRACKET

Mount bracket to computer as shown above & torque Nylock nut to 25-35 inch-pounds.

Compiled	MURRELL	SHOP PRACTICE WIRING DIAGRAMS, ANTI-LOCK SYSTEM	33-06131
Approved	Ctab		
Issued	2-17-75	Chg Ltr B **FREIGHTLINER CORPORATION** PORTLAND, OREGON	
Revised	10-30-81		

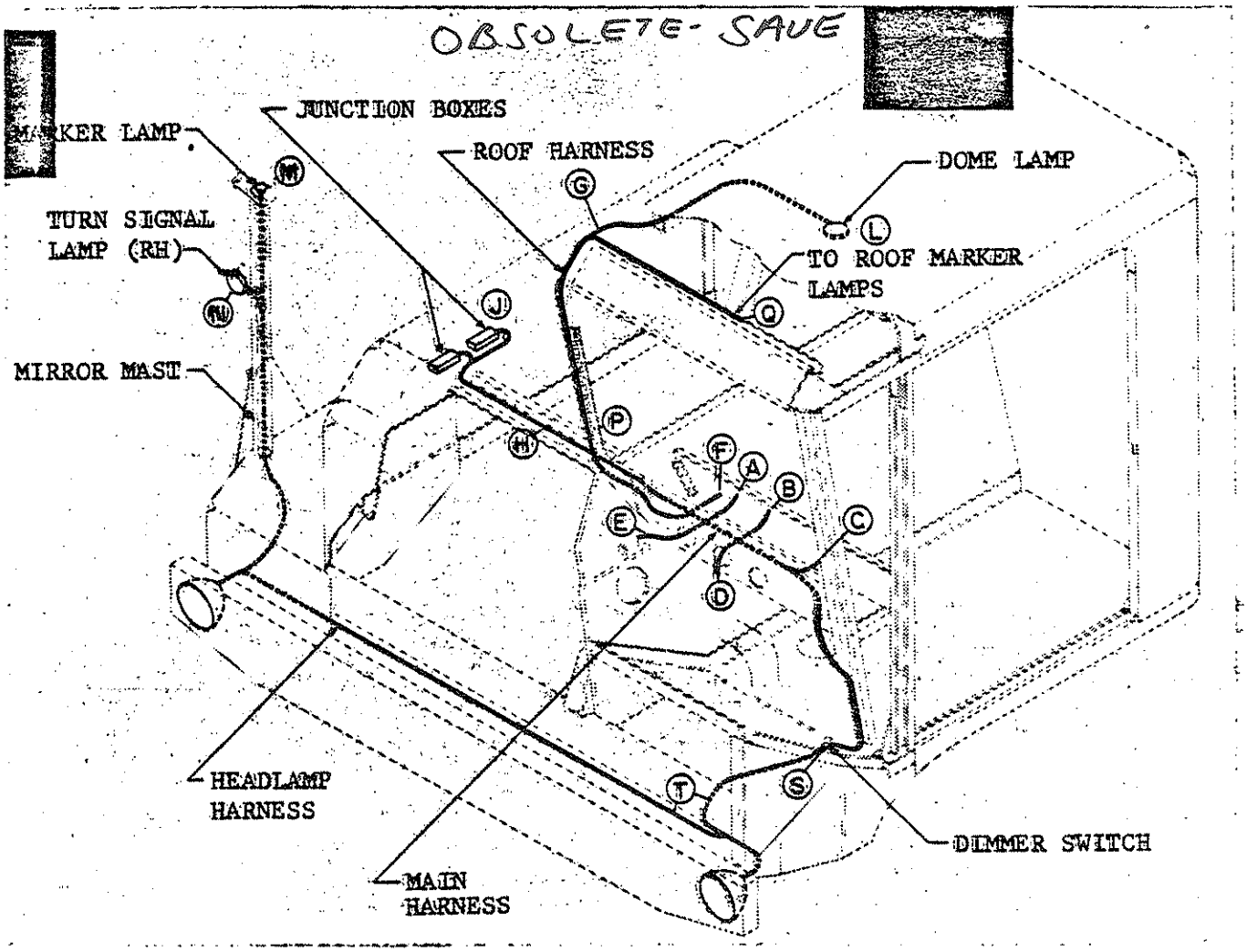
OBSOLETE - SAVE

The following wiring diagrams are to be used for FMVSS #121 anti-lock systems.

	MFR	VEHICLE GROUND	DIAGRAM NUMBER
	(WAG) Wagner	Pos-Neg	D06-11480
B	(WAG) Wagner	Pos-Neg	D06-12259 (71 plus)
A			
	(KH) Kelsey-Hayes	Neg	D06-11481
	(KH) Kelsey-Hayes	Pos	D06-11499
A	(ROK) Rockwell	Neg	D06-11693
A	(ROK) Rockwell	Pos	D06-11694

Compiled	H.J.R.	SHOP PRACTICE HARNESS ROUTING, CAB WIRING HALF CAB	33-06201
Approved	R PHILLIPS		
Issued	9-29-69	Chg Ltr B	
Revised	10-6-69	FREIGHTLINER CORPORATION PORTLAND, OREGON	

OBSOLETE - SAVE



1. The main cab harness runs from the dash Ⓐ, Ⓑ, Ⓒ, & Ⓓ, to:

   a. Junction boxes Ⓙ, by way of the tunnel hat section Ⓗ.
   b. Tunnel area and left frame rail area thru forward section of tunnel Ⓔ.
   c. Dimmer switch Ⓢ, where it splices to the headlight harness Ⓣ.

2. The roof harness runs from dash switches to the cab roof through the right hand windshield post Ⓟ, and, the roof brace through Ⓠ, to the roof marker lamps. A branch Ⓒ, at the right forward roof corner goes back to the dome lamp Ⓛ, in the middle of the cab ceiling.

3. The headlamp harness Ⓣ, runs from a splice with the main harness at the dimmer switch Ⓢ, along the bumper to each of the headlamps, then up the mirror mast at the front right hand corner to the right turn signal lamp Ⓝ, and marker lamp Ⓜ.

B Revised & Redrawn

Compiled	F. FREER
Approved	
Issued	4-30-73
Revised	6-25-87

SHOP PRACTICE
TRANSMISSION

33-07100
CONTENTS

Chg Ltr N

FREIGHTLINER CORPORATION
PORTLAND, OREGON

P*A078-18

GROUP & TOPIC NO.	DESCRIPTION
33-07103	LUBRICATION
33-07104	ALLISON TRANSMISSION INSTALLATION
33-07105	SUPPORT INSTALLATION, TRANSMISSION
N 33-07106	SPICER TRANSMISSION, BRACKET ATTACHMENT
33-07107	TRANSMISSION INSTALLATION, GENERAL
33-07108	TRANSFER CASE MOUNTING
33-07109	TORQUING OF SCREW FASTENERS
33-07111	RETARDER CONTROL, ALLISON MT
33-07112	END YOKE TORQUE VALUE
33-07114	SPEEDOMETER DRIVE INSTALLATION MECHANICAL
	SPEEDOMETER PICK UP INST. ELECTRICAL - SEE 33-22105
33-07115	SHIFT JOINT ASSEMBLY

	ROUTING OF FLEXIBLE LINES	12101
	FOR	SEE

COMPILED	ERK
APPRV	HSB
ISSUE DATE	10/02/72
REV DATE	07/29/96
CHG LTR	G

SHOP PRACTICE

TRANSMISSION
LUBRICATION

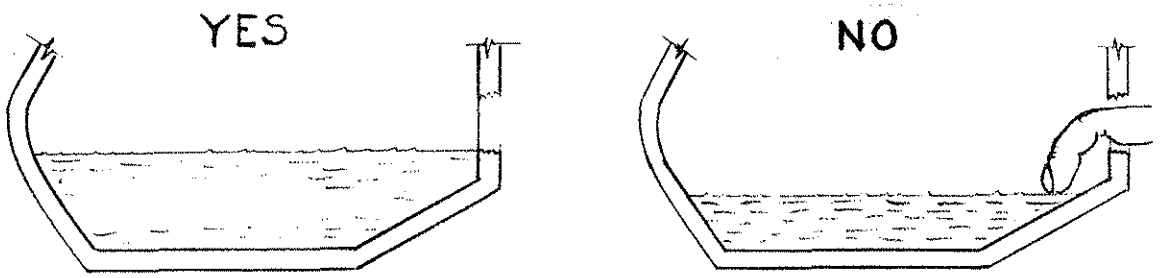
FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-07103

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0007-001 FOR TRANSMISSION LUBRICATION.

1. OIL FILL



Correct oil fill for transmissions brings the oil level up to the lower edge of the filler opening. CAUTION: Do not consider adequate fill because the oil surface can be reached with a finger.

Also, guard against overfilling--too much oil can cause excessive heat and leakage.

2. LUBRICATION TYPE & QUANTITY

E

Lubricate Main & Auxiliary Transmission. Transfer Case per VEHICLE LUBRICATION CHART (Form E-47, latest revision), 33-00102.

E

COMPILED	HEILESON	SHOP PRACTICE TRANSMISSION INSTALLATION-ALLISON	SECTION NUMBER 33-07104
APPRV	DCR		
ISSUE DATE	03/11/87		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

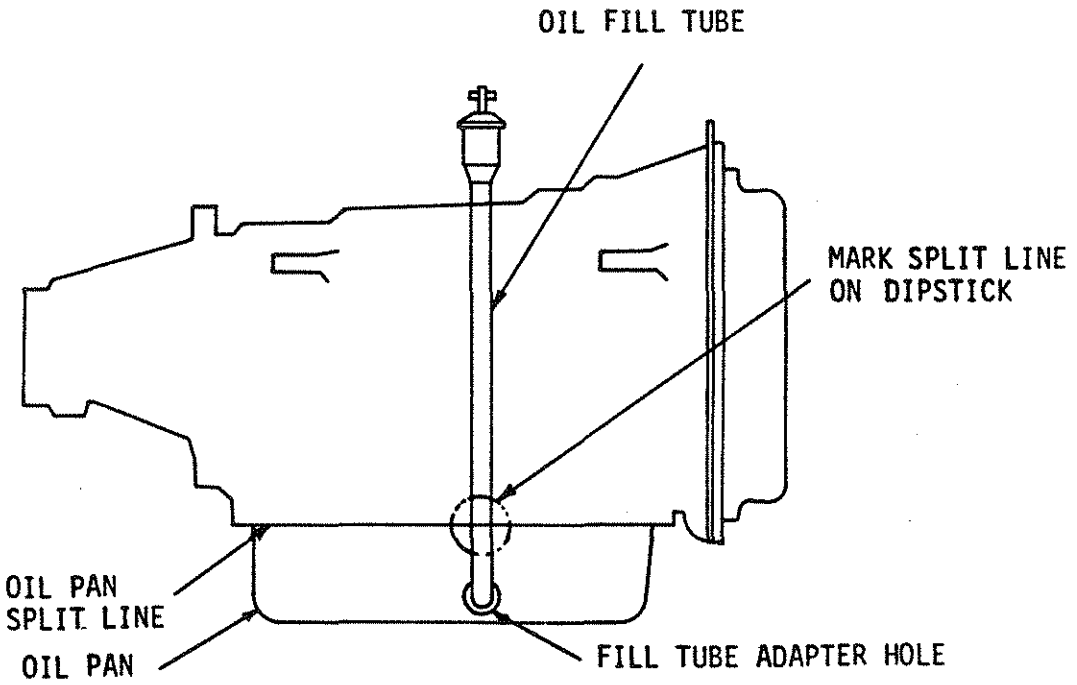
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0007-002 FOR ALLISON TRANSMISSION INSTALLATION.

A. DIPSTICK MARKING

1. Mark the transmission dipstick by using one of the following methods.

   a. Hold the dipstick against outside of the tube in the same position as it would be if pressed firmly in the tube. Project Horizontally, with a level or square, from the oil pan split line to the dipstick tube and mark the split line on dipstick.

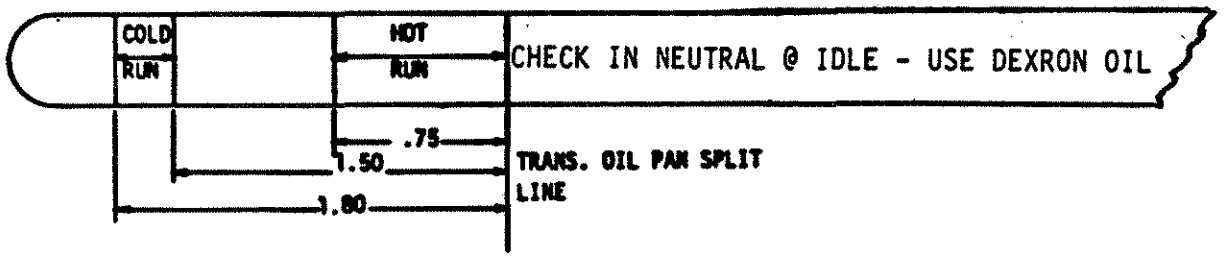
   b. Check the data on the print, select the dipstick, and take it to the measuring table. Place the dipstick in the locating fixture which measures from the seal.



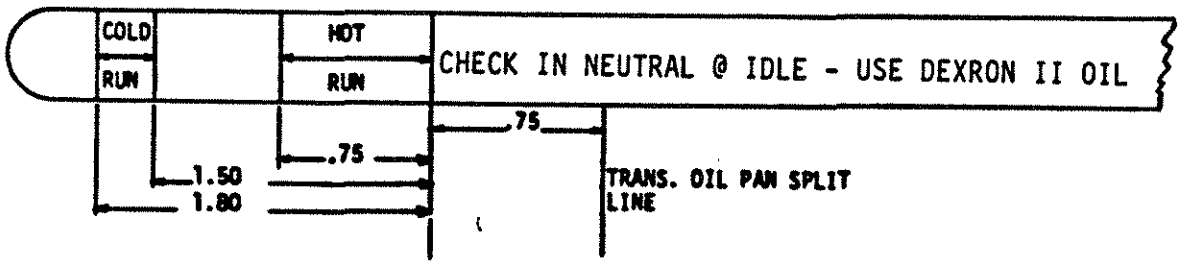
2. Mark the dipstick as shown on page 2. Lettering to be depressed block type .005-.010" (.13-.25 mm) deep .125-.187" (3.18-4.75 mm) high.

A. DIPSTICK MARKING (CONT'D)

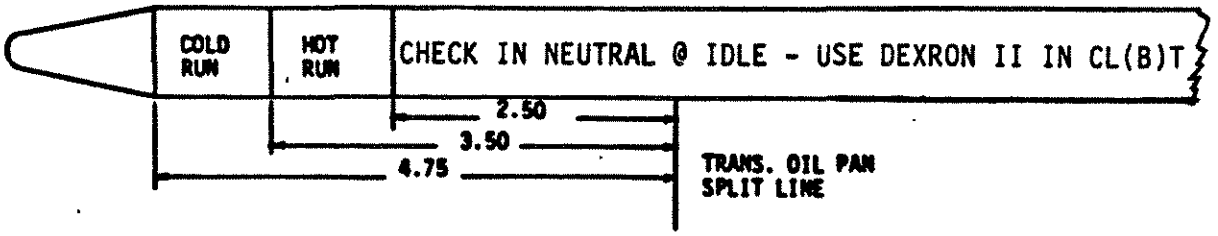
a. MT 643/653/644



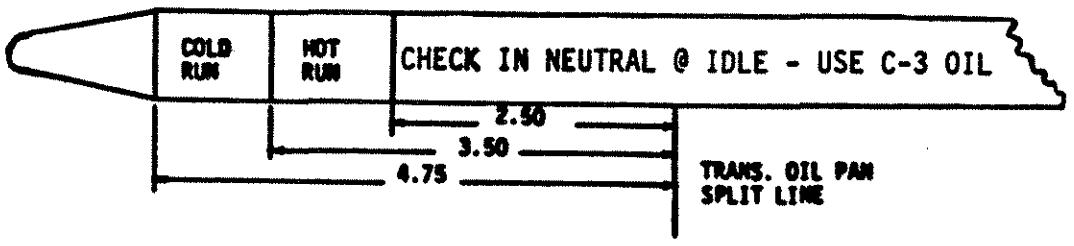
b. MT 654 CR



c. HT 700



d. CL(B) T SERIES



B. MOUNTING TO ENGINE

1. Lubricate the center pilot boss with molybdenum disulphide grease.

2. Align one of the 13 bolt holes in the flex plate with the access opening in the front of the engine flywheel housing. Install a headless 1/2-20 guide bolt in a corresponding hole in the transmission flywheel (torque converter).

3. Push the transmission toward the engine while guiding the pilot boss on the flywheel into the flex plate hub, and the guide bolt into one of the holes in the flex plate. The transmission should seat squarely against the engine flywheel housing without force. If interference is encountered, move the transmission away from the engine and investigate the cause.

4. Install the 7/16 bolts that attach the flywheel housing to the transmission housing finger tight. The converter housing must be flush against the engine flywheel housing before tightening any bolts. Do not use the bolts to seat the housing. Tighten bolts in accordance with 33-07107

   NOTE: Bolts going into an aluminum flywheel housing must have at least 7/8" thread engagement.

5. Remove the guide bolt through the access opening in the engine flywheel housing and replace it with a 1/2-20 x 1 inch self locking bolt. While rotating the engine, install the flex plate to transmission flywheel bolts finger tight. Do not tighten any flywheel bolts until all of the bolts have been installed finger tight. When all bolts are in place, tighten them to 96-115 ft/lbs.

6. Install the flywheel housing access cover.

C. ESTABLISHING OPERATION FLUID LEVEL

Before adding oil, be sure fill tube is free of dirt and grinding dust.

Always verify that the oil level is correct before putting the transmission under load.

C. ESTABLISHING OPERATION FLUID LEVEL (CONT'D)

1. Before starting the engine, fill transmission in accordance with the "Initial Oil Fill Quantities Table" in Section "D".
2. Crank engine in neutral.
3. Run for approximately 1 minute to fill converter and cooler, shut engine off.
4. Clean the exposed part of the dipstick and the area immediately around it before removing the dipstick.
5. Add fluid to **"COLD RUN"** on dipstick.
6. (With the vehicle on a level surface) Start the engine and run it at a fast idle until normal operation temperature (160 degrees Fahrenheit, minimum) is attained.
7. Move the selector control through each selector position to fill all clutches.
8. Check fluid level with transmission in neutral and engine running at idle. Add or drain as required to put level at **"HOT RUN"** point.
9. Do not over fill.

D. INITIAL OIL FILL QUANTITIES

The initial fill quantities listed below include one (1) gallon for hoses, filter and cooler. Caution, always verify the oil level is correct before putting the transmission under load.

NON-RETARDER EQUIPPED MODELS

SERIES	OIL PAN	QUANTITY (GAL)
MT	ALL	5.5
HT	STAMPED STEEL 6" OR 7" PAN DEPTH	8.5
	CAST IRON 8" PAN DEPTH	11.75
	ALUMINUM 4.5" PAN DEPTH	9.5

OUTPUT RETARDER EQUIPPED MODELS

Add 1/2 gallon to each of the above figures.

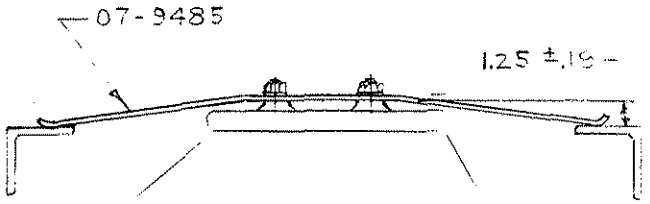
COMPILED	MCINTOSH	SHOP PRACTICE SUPPORT INSTALLATION TRANSMISSION	SECTION NUMBER 33-07105
APPRV	BRISTOW		PAGE 1 OF 1
ISSUE DATE	10/29/73		
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	B		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0007-003 FOR TRANSMISSION SUPPORT INSTALLATION.

Compiled	McIntosh	SHOP PRACTICE SUPPORT INSTALLATION, TRANSMISSION	33-07105
Approved	BRISTOL		
Issued	10-29-73	Chg Ltr A **FREIGHTLINER CORPORATION** PORTLAND, OREGON	P*A078-18
Revised	6-23-20		

SPRING SUPPORT

Install the transmission support spring so that, as finally installed, the spring will be deflected 0.50 ± .19 inches from its free arched position. This means that deflected height of the spring as installed will be 1.25 ± .19 inches. (See sketch).



A SPICER SST TRANSMISSIONS

These transmissions are shipped with 2.00 inch long nylon patch capscrews installed in the rear mounting holes. These capscrews are to be used in the installation of the support spring described above.

Compiled	L. Deyo	SHOP PRACTICE SPICER TRANSMISSION BRACKET ATTACHMENT	33-07106
Approved	DRC		
Issued	6-25-87		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-18

SPICER TRANSMISSIONS:

When attaching a bracket to the shift bar housing cover, use only the existing bolts. At the left from and right rear of the housing thre are blind threaded holes. These are not to be used for attaching brackets. These are only to be used to remove the cover for service. Use of these with the attaching bolts in place may result in a cracked cover.

APPRV	HJR
ISSUE DATE	06/20/75
REV DATE	07/29/96
CHG LTR	F

SHOP PRACTICE

TRANSMISSION INSTALLATION
GENERAL

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-07107

PAGE
1 OF 1

PA2042-72

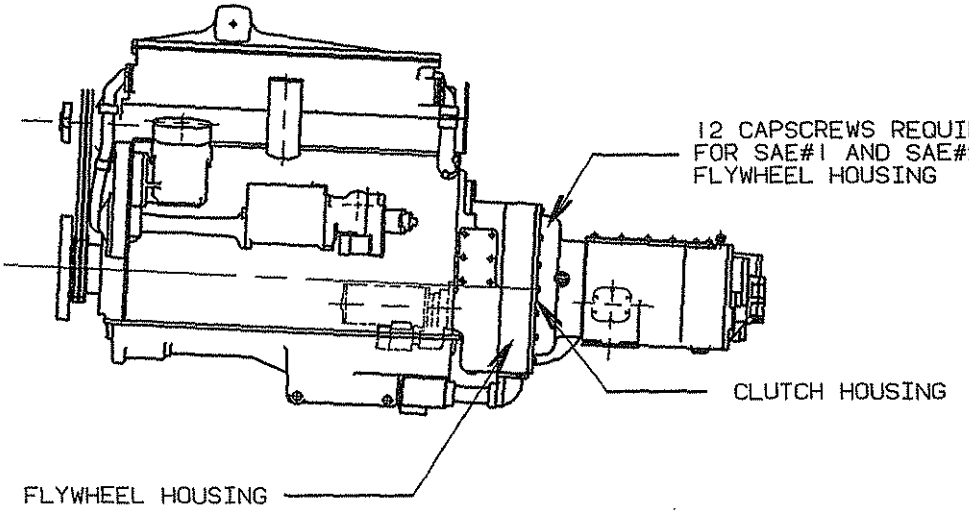
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0007-004 FOR TRANSMISSION INSTALLATION, GENERAL.

COMPILED	L.DEYO	SHOP PRACTICE TRANSMISSION INSTALLATION GENERAL	SECTION NUMBER 33-07107
APPRV	H.J.R.		PAGE 1 OF 1
ISSUE DATE	06/20/75	FREIGHTLINER CORPORATION PORTLAND, OREGON	P3747H-01
REV DATE	02/09/93		
CHG LTR	D		

TRANSMISSION TO ENGINE MOUNTING

1. SCOPE:

TRANSMISSION TO ENGINE MOUNTING COVERS RECOMMENDED PRACTICE FOR INSTALLING THE FASTENERS ATTACHING THE TRANSMISSION/CLUTCH ASSEMBLY TO THE ENGINE ASSEMBLY AT THE FLYWHEEL HOUSING.



2. FASTENER USAGE

GRADE 8 CAPSCREWS CALLED OUT IN MODULES 340 OR 342 SHALL BE A MINIMUM OF 1 1/2 INCHES LONG. LONGER CAPSCREWS MUST BE USED WHEN BRACKETS OR A BRAKESAVER IS INSTALLED.

A HARDENED WASHER, AS SPECIFIED, SHALL BE INSTALLED UNDER THE HEADS WHEN CAPSCREWS WITH PATCH-LOK ARE SPECIFIED (WITH IRON OR ALUMINUM CL HOUSINGS).

A SPLIT RING LOCKWASHER SHOULD BE USED WHEN A STANDARD(NON-LOCKING) CAPSCREW IS SPECIFIED (IRON CL HOUSINGS).

A STAR LOCKWASHER SHOULD BE USED WHEN A STANDARD(NON-LOCKING) CAPSCREW IS SPECIFIED (ALUMINUM CL HOUSINGS).

3. FASTENER INSTALLATION

WITH PILOT PROPERLY ENGAGED, AND HOUSING FLANGES CLOSE TO PROPER POSITION SO THAT CAPSCREWS CAN BE READILY STARTED WITH FINGERS ONLY, INSERT THE CAPSCREWS WITH PROPER WASHER UNDER THE HEAD. USING A CRISS-CROSS ALTERNATE PATTERN, TIGHTEN SCREWS TO 20 FT.LB. TORQUE. WHEN THIS PRELIMINARY TORQUING IS COMPLETED, RETORQUE IN SIMILAR ALTERNATING PATTERN TO A FINAL VALUE OF 35-45 FT.LB.

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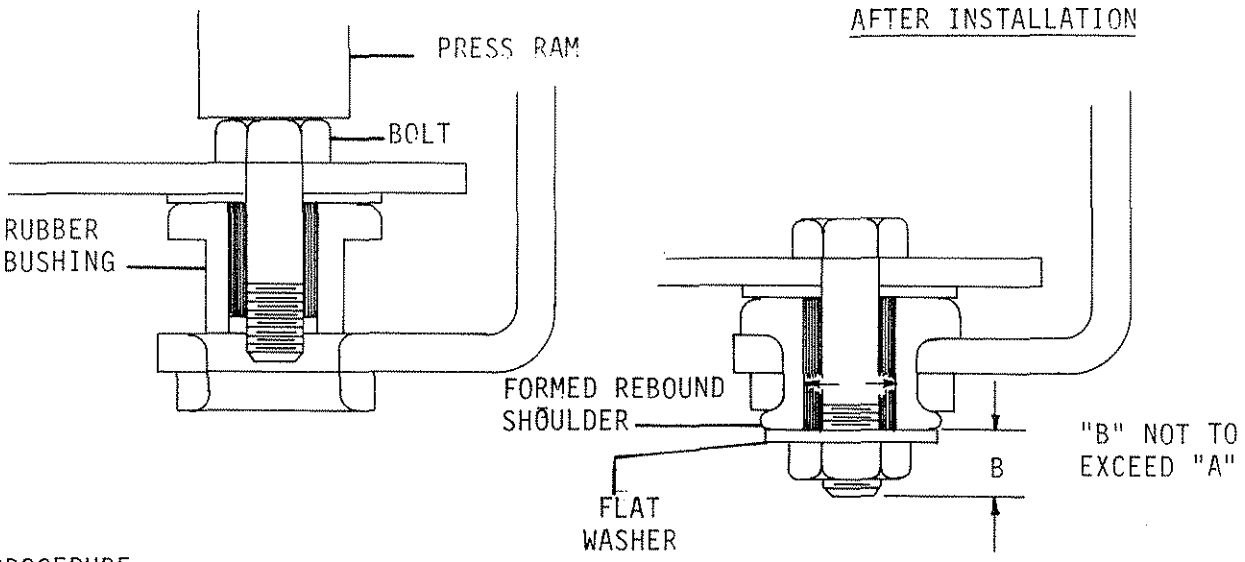
ON ID=

COMPILED	MCINTOSH	SHOP PRACTICE	SECTION NUMBER
APPRV	T D		33-07108
ISSUE DATE	11/24/69	TRANSFER CASE MOUNTING	PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	C		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0007-005 FOR TRANSFER CASE MOUNTING PROCEDURE.

FRONT MOUNT INSTALLATION



PROCEDURE:

1. Lubricate bushing lightly with rubber lubricant or water. (Do not use grease or oil).

2. Position rubber bushing with the large end upward.

3. Insert bolt (or assembly fixture, if used) through the tubular metal spine. The bolt should not extend beyond the lower end of the spine more than a length equal to the outside diameter of the spine. (See sketch.)

4. Apply sufficient pressure to seat the mounting in the socket.

5. With bolt in place, install flat washer and prevailing torque locknut and tighten (to approx. 130-145 FT/LB torque for a 5/8-18 UNC Grade 5 Bolt), seating the washer firmly against the spine. The rebound shoulder is formed automatically as the washer approaches its seat.

B

Compiled	H.J.R.	SHOP PRACTICE RETARDER CONTROL ALLISON MT-SERIES TRANSMISSION	33-07111
Approved	BRISTOW		
Issued	4-30-73	Chg Ltr	P*A078-18
Revised		**FREIGHTLINER CORPORATION** PORTLAND, OREGON	

1. PEDAL

The pedal controlling the retarder action of the Allison Transmission is to be painted Red. Clean as required, then paint entire WM471A foot valve assembly with Dupont Dulux Red #93-26550H.

2. INSTRUCTION LABEL

The retarder operating instruction label is placed on the cab wall to the right of the driver just below the shift box. On upholstered tunnels first mount the label on an aluminum plate, then attach this to the cab wall.

Renumbered; was 33-07201.

Compiled	F. Freer	SHOP PRACTICE TRANSMISSION END YOKE TORQUE VALUES	33-07112
Approved	Morrison		
Issued	6-27-78		
Revised	6-4-79	Chg Ltr A **FREIGHTLINER CORPORATION** PORTLAND, OREGON	P*A078-18

END YOKE TORQUE VALUES

A

Transmission	Torque
Allison	600-800 Ft. Lb.
Fuller	450-500 Ft. Lb.
Spicer	550-600 Ft. Lb.

Compiled	T. FREER		
Approved	[signature]	SHOP PRACTICE SPEEDOMETER DRIVE INSTALLATION MECHANICAL	33-07114
Issued	7-20-79		
Revised	7-20-84 Chg Ltr B	FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-38

A

1. COE

   The speedometer drive is to be located in the left hand section of the drive housing. Should right hand (drive) be required, see #2.

2. CONVENTIONAL

   The speedometer drive is to be located in the right hand section of the drive housing. The drive housing is to be unbolted, rotated to proper position and rebolted.

3. MECHANICAL SPEEDOMETER O-RING SEAL INSTALLATION

B

   Fuller transmission requires an O-ring for the mechanical speedometer sleeve (SW/9011) to prevent oil seepage from around the thread.

   Transfer the O-ring from the Fuller plug (FUL/20226) to the sleeve.

Compiled	NJR	SHOP PRACTICE DRIVESHAFT, CONTENTS	33-09100
Approved			
Issued	06/27/67		
Revised	07/21/88	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-38

PRACTICE NO.	DESCRIPTION
33-09101	DRIVESHAFT INSTALLATION
33-09102	LUBRICATION, DRIVESHAFT
33-09109	FASTENERS, DRIVESHAFT

COMPILED	HJR	SHOP PRACTICE INSTALLATION DRIVESHAFT BEARING	SECTION NUMBER 33-09101
APPRV	GHA		
ISSUE DATE	12/14/87		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0009-001 FOR DRIVE SHAFT BEARING INSTALLATION.

COMPILED	HJR
APPRV	GHA
ISSUE DATE	12/14/87
REV DATE	06/14/94
CHG LTR	C

SHOP PRACTICE
INSTALLATION
DRIVESHAFT BEARINGS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-09101

PAGE
1 OF 1

P4216K-01

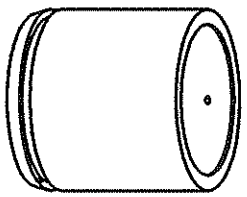
1. GENERAL PROCEDURE

1.1 BEARING INSTALLATION, DRIVESHAFT

1.1.1 REMOVE ALL RUST AND DIRT FROM YOKE BEARING SADDLES.

1.1.2 **DO NOT** REASSEMBLE BEARING CUP ASSEMBLY IF NEEDLE BEARINGS ARE REMOVED.

HALF ROUND/EASY SERVICE
BEARING CUP



1.2 INSTALLATION OF HALF ROUND/EASY SERVICE YOKE BEARINGS

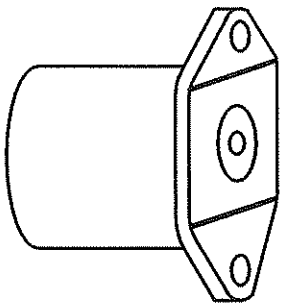
1.2.1 HALF ROUND/EASY SERVICE BEARING CUPS ARE WIRED TO U-JOINT AND **SHOULD NOT** BE REMOVED DURING ASSEMBLY OF DRIVE SHAFT ON VEHICLE.

1.2.2 **DO NOT LUBRICATE** THE BEARING SADDLES OF THE TRANSMISSION OR AXLE YOKES WITH ANTI-SEIZE COMPOUND OR CHASSIS GREASE.

1.2.3 SEAT BEARING INTO YOKE SADDLE BY TAPPING LIGHTLY.

1.2.3.1 DO NOT USE STRAPS TO SEAT BEARING IN YOKE SADDLE.

FULL ROUND
BEARING CUP



1.3 INSTALLATION OF FULL ROUND YOKE BEARINGS

1.3.1 WHEN THE BEARING CUP IS REMOVED FOR DRIVELINE INSTALLATION, INSURE THAT GREASE IS PRESENT IN THE BEARING PACKAGE.

1.3.2 TAP THE BEARING CUPS IN WITH A LEATHER OR RUBBER MALLET.

1.3.2.1 IF BEARINGS WILL NOT GO IN, CHECK FOR DIRT, FALLEN ROLLER, OR FOR IMPROPER ALIGNMENT.

B
C

LAST FILE=9411011115
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=08.10 ACCESS=NONE
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TE= 6/24/94
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COMPILED	J M	SHOP PRACTICE DRIVESHAFT LUBRICATION	SECTION NUMBER 33-09102
APPRV	LEVINGS		
ISSUE DATE	05/20/74		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0009-002 FOR DRIVESHAFT LUBRICATION.

Compiled	J. McL.	SHOP PRACTICE DRIVESHAFT LUBRICATION	33-09102
Approved	[illegible]		
Issued	5-20-74		
Revised	12-1487	Chg Ltr B	

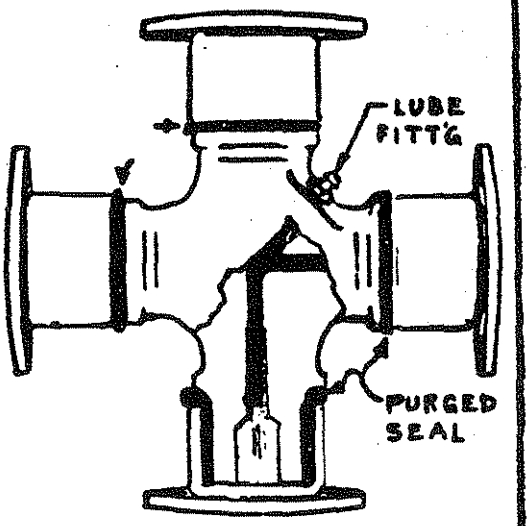
FREIGHTLINER CORPORATION
PORTLAND, OREGON

LUBRICATION

A. SPICER UNIVERSAL JOINTS

(a) Lubricate per VEHICLE LUBRICATION CHART (Form E-47, latest revision), Ref. 33-00102.

(b) At lube fitting in hub of journal cross, apply lube gun to add lubricant until it appears at all four bearing seals. (Spicer seals are designed to relieve.)



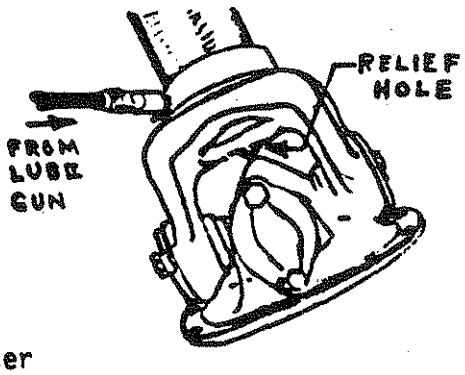
(c) If all the seals do not "pop" when being lubed, move the drive shaft laterally in all four directions, or push on the drive shaft in the direction opposite to the journal cross seal not relieving while lube gun pressure is being applied. (An increase in pressure may also be necessary.)

(d) If seal still fails to relieve, disassemble, correct as necessary, reassemble and again apply lube gun until all four seals relieve.

B. SPICER SLIDING SPLINE SECTIONS

(a) Lubricate per VEHICLE LUBRICATION CHART (Form E-47, latest revision), Ref. 33-00102.

(b) Apply grease gun pressure to lube fitting until lubricant appears at pressure relief hole in welch plug at sleeve yoke end of spline.



(c) Cover relief hole with finger and continue to apply pressure until grease appears at sleeve yoke seal. This will insure complete lubrication of spline.

A Note: Spline lubrication should be done after driveline is installed in vehicle, otherwise it may be difficult to collapse slip joint during installation.

COMPILED	R.ROLLINS	SHOP PRACTICE FASTENERS DRIVESHAFT	SECTION NUMBER 33-09109
APPRV	RG		PAGE 1 OF 1
ISSUE DATE	09/13/67		
REV DATE	04/18/94	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		P0904J-14

FLANGE BOLTS

FLANGE BOLTS SHOULD BE ALLOY STEEL EQUIVALENT TO S.A.E. GRADE 8 BOLTS. THE NUTS SHOULD BE TORQUED TO THE FOLLOWING SPECIFICATIONS:

B

5/16-24 UNF	22-26 FT/LBS.
3/8-24 UNF	40-48 FT/LBS.
7/16-20 UNF	63-75 FT/LBS.
1/2-20 UNF	97-116 FT/LBS.

BEARING CAP AND RETAINING STRAP SCREWS

BEARING CAP AND RETAINING STRAP SCREWS ARE OF ALLOY STEEL MEETING S.A.E. GRADE 8 SPECIFICATIONS. EXCESSIVE TORQUES SHOULD BE AVOIDED ON THESE SCREWS DUE TO THE EXTREME LOAD OCCURRING AT HIGH SPEED ROTATION. A SCREW FAILURE AT ANY OF THESE POINTS MAY RESULT IN COMPLETE FAILURE OF THE DRIVE SHAFT. LOCK PLATES ARE NOT REQUIRED.

BEARING CAP

C
D

SCREWS WITH PATCH LOCK FOR "WITH OUT LOCK PLATE" AND STANDARD SCREWS FOR "WITH LOCK PLATE" FOR "ROCKWELL" AND "DANA" FULL ROUND APPLICATION SHOULD BE TORQUED TO THE FOLLOWING SPECIFICATIONS:

5/16-24 UNF	26-35 FT/LBS.
3/8-24 UNF	38-48 FT/LBS.

B

BEARING RETAINING STRAP

THESE SCREWS ARE USED WITH "ROCKWELL EASY SERVICE" AND "DANA HALF ROUND" AND SHOULD BE TORQUED TO THE FOLLOWING SPECIFICATIONS:

D

3/8-24 UNF	45-60 FT/LBS.
1/2-20 UNF	115-135 FT/LBS.

U-BOLT NUTS

ON SMALLER SIZE UNIVERSAL JOINTS, U-BOLT STYLE AND YOKE ARE USED. THIS CONSTRUCTION ALLOWS EASIER ASSEMBLY WHERE THE SMALLER SIZE BEARINGS PERMIT THEIR USE. THE BEARING RACE IS SEATED IN A HALF ROUND HOLE AND UNDER LOCATING EARS. THE U-BOLTS ARE ASSEMBLED OVER THE BEARING RACES TO RETAIN THEM IN THE END YOKES. SPRING LOCKWASHERS AND NUTS SHOULD BE USED WITH THESE U-BOLTS AT ASSEMBLY. THEY SHOULD BE TORQUED TO THE FOLLOWING SPECIFICATIONS:

5/16-24 UNF	14-17 FT/LBS.
3/8-24 UNF	20-24 FT/LBS.
7/16-20 UNF	32-37 FT/LBS.

B

THESE TORQUE SPECIFICATIONS ARE SOMEWHAT LIGHTER THAN NORMALLY USED WITH THESE THREAD SIZES; HOWEVER, THE LOWER TORQUES ARE REQUIRED TO PREVENT BEARING RACE DISTORTION.

COMPILED	F.FREER
APPRV	DCR
ISSUE DATE	04/07/65
REV DATE	03/01/93
CHG LTR	T

SHOP PRACTICE

FRONT AXLE
CONTENTS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-10100

PA2042-32

	PRACTICE NO.	DESCRIPTION
	33-10101	WHEEL BEARING ADJUSTMENT
	33-10102	WHEEL BEARING CUP INSTALLATION
	33-10103	FRONT BRAKE INSTALLATION
	33-10104	FRONT AXLE ALIGNMENT
	33-10105	STEERING TIE ROD ADJUSTMENT
	33-10106	AUTOMATIC SLACK ADJUSTER INSTALLATION
	33-10107	ATTACHMENTS TO FRONT AXLE
	33-10108	WHEEL OIL SEAL INSTALLATION
	33-10109	DUST SHIELD INSTALLATION EATON BRAKE
	33-10110	LUBRICATION
	33-10111	BRAKE CHAMBER INSTALLATION
	33-10112	BRAKE ADJUSTMENT
	33-10113	DISC BRAKE PAINTING, ROCKWELL
	33-10114	FRONT AXLE INSTALLATION
	33-10115	INSTALLATION OF ROK AUTOMATIC SLACK ADJUSTERS
T	33-10116	LUBRICATION, GREASE, FRONT WHEEL BEARINGS

COMPILED	HADDOCK	SHOP PRACTICE WHEEL BEARING ADJUSTMENT FRONT AXLE	SECTION NUMBER 33-10101
APPRV	KRH		
ISSUE DATE	04/07/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	H		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-001 FOR WHEEL BEARING ADJUSTMENT/FRONT AXLE.

COMPILED	HADDOCK
APPRV	KRH
ISSUE DATE	04/07/65
REV DATE	07/06/94
CHG LTR	G

SHOP PRACTICE

WHEEL BEARING ADJUSTMENT FRONT AXLE

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-10101
PAGE 1 OF 3
P4424N-01

THE ADJUSTMENT OF WHEEL BEARINGS HAS A PROFOUND INFLUENCE ON THEIR LIFE EXPECTANCY. IT SEEMS GENERALLY AGREED THAT IDEAL BEARING ADJUSTMENT WOULD BE ONE THAT NEITHER IMPOSED PRELOAD ON THE BEARINGS, NOR ALLOWED ENDPLAY. HOWEVER, BOTH HUMAN AND MECHANICAL FACTORS PREVENT ACHIEVING THIS IDEAL AND THE ASSEMBLIES END UP WITH SOME PRELOAD OR SOME ENDPLAY.

EXPERIENCE TEACHES FURTHER THAT WHEEL BEARINGS WITH A SLIGHT AMOUNT OF PRELOAD WILL GIVE LONGER LIFE EXPECTANCY THAN ONES WITH A SLIGHT AMOUNT OF ENDPLAY THE FOLLOWING ADJUSTMENT PROCEDURE SHOULD CONSISTENTLY RESULT IN BEARINGS WITH A SLIGHT AMOUNT OF PRELOAD. NOTE THAT THIS PROCEDURE DOES NOT INVOLVE THE ELEMENT OF "FEEL" ON THE PART OF THE MECHANIC.

1. STANDARD SINGLE SPINDLE NUT ADJUSTMENT

1.1 ASSEMBLE BEARINGS AND HUB ON THE STEERING KNUCKLE.

1.2 INSTALL THRUST WASHER.

1.3 INSTALL WHEEL BEARING ADJUSTING NUT. SCREW NUT AGAINST THE BEARING OR THRUST WASHER AS THE WHEEL IS REVOLVED. BE SURE THERE IS SUFFICIENT CLEARANCE BETWEEN THE BRAKE SHOE AND DRUM SO BRAKE SHOE DRAG WILL NOT INTERFERE WITH BEARING ADJUSTMENT. TIGHTEN TO 90-110 LB.FT. TORQUE TO SEAT, WHILE ROTATING WHEEL IN BOTH DIRECTIONS.

1.4 LOOSEN NUT 1/2 TO 1 TURN UNTIL ZERO TORQUE IS ACHIEVED. ROTATE WHEEL A FEW TURNS.

1.5 TIGHTEN THE ADJUSTING NUT TO 15 LB.FT. TORQUE WHILE THE WHEEL IS BEING ROTATED IN BOTH DIRECTIONS AND INSTALL LOCKING MECHANISM OR COTTER PIN.

1.5.1 IF LOCKING MECHANISM CAN NOT BE INSTALLED, TIGHTEN NUT UNTIL LOCK CAN BE INSTALLED.

1.5.2 TURN NUT TO CLOSEST POSITION THAT ENABLES THE COTTER PIN TO BE INSTALLED.

2. STANDARD DOUBLE SPINDLE NUT ADJUSTMENT

2.1 FOLLOW STEPS 1.1 THRU 1.4.

2.2 TIGHTEN THE ADJUSTING NUT TO 50 LB.FT. TORQUE WHILE THE WHEEL IS BEING ROTATED IN BOTH DIRECTIONS.

2.3 BACK OFF ADJUSTMENT NUT 1/6 TO 1/4 TURN FOR CORRECT BEARING ADJUSTMENT.

2.4 ASSEMBLE LOCKING MECHANISM AND LOCK WASHER. TIGHTEN JAM NUT AS FOLLOWS:

LOCK TYPE		NUT SIZE	TORQUE	
			MIN.	MAX.
A	BEND-TYPE LOCK WASHER BETWEEN ADJUSTING NUT AND JAM NUT.	1-1/8 TO 2-1/2	100	150
		2-5/8 AND OVER	100	200
B	DOWELED ADJUSTING NUT AND PIERCED WHEEL BEARING NUT LOCK. (3 PIECE)	1-1/8 TO 2-1/2	200	300
		2-5/8 AND OVER	250	400
C	DOWELED ADJUSTING NUT AND PIERCED WHEEL BEARING NUT LOCK WITH LOCK WASHER W/TABS. (4 PIECE)	1-1/8 TO 2-1/2	200	300
		2-5/8 AND OVER	250	400

G

2.4.1 AFTER TIGHTENING THE JAM NUT:

2.4.1.1 LOCK TYPE "A":

BEND THE WHEEL BEARING NUT LOCK-WASHER OVER BOTH THE ADJUSTING AND JAM NUTS TO COMPLETE THE ADJUSTING PROCEDURE.

G

CAUTION: THE ADJUSTING NUT (THIN ONE WITH SHOULDER TO FIT AGAINST BEARING) GOES ONTO THE SHAFT BEFORE THE JAM NUT. THE LOCKING PLATE, WITH TANGS OR OTHER HOLDING DEVICE, GOES BETWEEN THE TWO NUTS AND IS LOCKED AFTER PROPER NUT ADJUSTMENT HAS BEEN ATTAINED.

2.4.1.2 LOCK TYPE "C":

BEND LOCK WASHER TABS OVER TWO OPPOSING FLATS OF THE OUTER NUT.

3. PRO-TORQUE SPINDLE NUT ADJUSTMENT

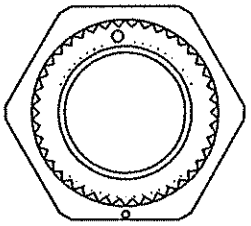
3.1 FOLLOW STEPS 1.1 THRU 1.5.

3.2 TIGHTEN NUT, IF NECESSARY, TO INSTALL LOCKING MECHANISM.

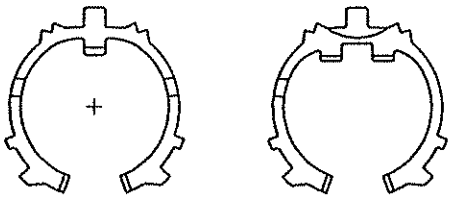
3.3 TO INSTALL INSERT KEEPER TAB INTO UNDERCUT GROOVE, SIMULTANEOUSLY ENGAGING KEYWAY TAB INTO SPINDLE KEYWAY AND ENGAGING MATING TEETH (SEE SKETCH #1).

NOTE: LOWER KEEPER PROJECTIONS MUST FACE AWAY FROM SPINDLE BEFORE INSTALLATION.

3.4 COMPRESS KEEPER ARMS AND INSERT INTO UNDERCUT GROOVE WITH SCREWDRIVER LIKE TOOL. MAKE CERTAIN KEEPER ARMS ARE LOCKED (FULLY SEATED) INTO UNDERCUT GROOVE (SEE SKETCH #2).



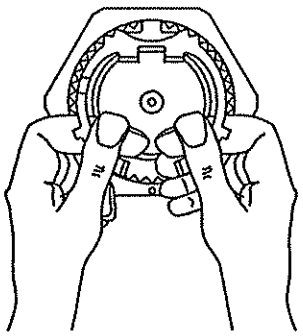
"PRO-TORQ" NUT



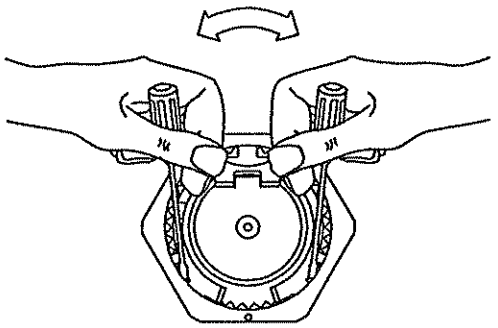
EATON ROCKWELL

"PRO-TORQ" KEEPERS

SKETCH #1



SKETCH #2



COMPILED	HADDOCK	SHOP PRACTICE WHEEL BEARING CUP ADJUSTMENT	SECTION NUMBER 33-10102
APPRV	MORRISON		
ISSUE DATE	01/15/68		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-002 FOR FRONT AXLE WHEEL BEARING CUP ADJUSTMENT.

COMPILED	B E	SHOP PRACTICE INSTALLATION BRAKE, FRONT AXLE	SECTION NUMBER 33-10103
APPRV	KRH		
ISSUE DATE	01/06/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-003 FOR FRONT AXLE BRAKE INSTALLATION.

COMPILED	B. EVENS
APPRV	KRH
ISSUE DATE	01/06/86
REV DATE	07/07/94
CHG LTR	B

SHOP PRACTICE
INSTALLATION
BRAKE, FRONT AXLE

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-10103
PAGE 1 OF 1
P4435N-01

BRAKE INSTALLATION

CAM AND WEDGE BRAKES ARE TO BE ASSEMBLED TO THE AXLE FLANGE USING THE FASTENERS LISTED IN THE BILLS OF MATERIALS.

1. TIGHTENING SEQUENCE

1.1 THE BRAKE IS TO BE ASSEMBLED TO THE AXLE FLANGE WITH THE SPECIFIED FASTENERS AND THEN THE FASTENERS TIGHTENED TO THE FINAL TORQUE VALUE IN THE FOLLOWING SEQUENCE. REFER TO FIGURE 1.

1.1.1 WITH THE USE OF A TOOL, SNUG TIGHTEN THE FIRST FASTENER.

1.1.2 TIGHTEN THE REMAINING FASTENERS TO:

B

5/8-11 HEX CAPSCREW ..... 145 ±15 FT.LBS.

5/8-11 HEX FLANGE HEAD CAPSCREW ..... 180 ±20 FT.LBS.

1.1.2.1 WITH ABS INSTALLATIONS, SKIP THE FASTENER HOLE UTILIZED BY THE SENSOR AND PRECEDE TO THE NEXT FASTENER IN THE SEQUENCE.

1.1.3 TIGHTEN THE FIRST FASTENER TO THE SPECIFIED FINAL TORQUE VALUE.

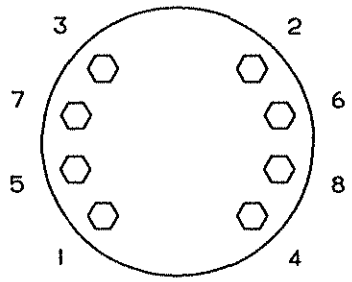
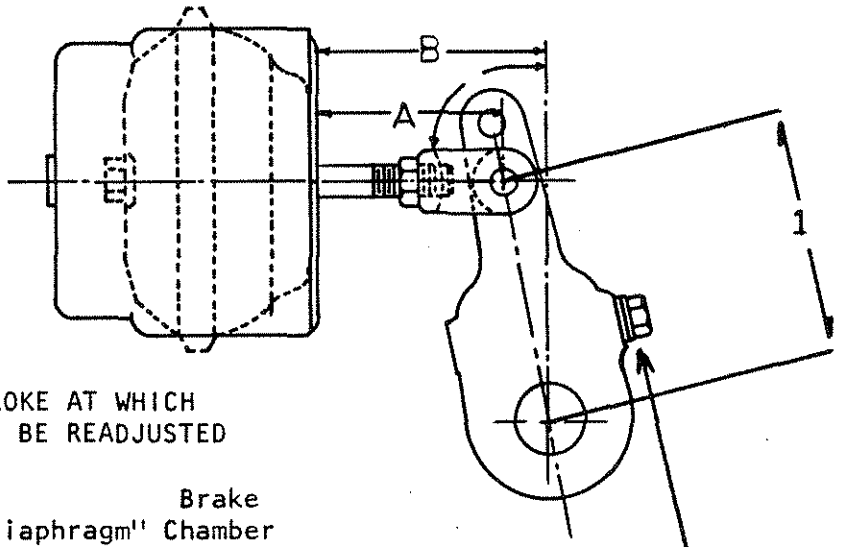


FIGURE 1

ADJUSTMENT

A. New linings should be about .060" to .070" less than drum diameter. Adjust slack adjusters or levers to obtain free running clearance.

CORRECT POSITION OF CHAMBER PUSH-ROD AND SLACK ADJUSTER IN "OFF" POSITION



NOTE: B minus A equals $\frac{1}{2}$" + $\frac{1}{2}$ of the stroke shown in the chart below.

CHAMBER STROKE AT WHICH BRAKE SHOULD BE READJUSTED

Chamber size Effective area	"Diaphragm" Chamber	Brake Chamber
9"	1 3/8"	1½"
12"	1 3/8"	1½"
16"	1 3/4"	1 3/4"
20"	----	1 3/4"
24"	1 3/4"	1 3/4"
30"	2"	2"

Adjuster to be mounted on the opposite side of the slack adjuster (in relation to the chamber) whenever possible.

1. Chamber is to be attached @ the 5.50" arm position on all vehicles.

REVISED & RETYPED (was page 3) P

E

E

COMPILED	ANDERSON	SHOP PRACTICE FRONT AXLE ALIGNMENT	SECTION NUMBER 33-10104
APPRV	FWATER		
ISSUE DATE	03/21/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-004 FOR FRONT AXLE ALIGNMENT.

WHEEL ALIGNMENT

Proper alignment of the front wheels must be maintained to insure ease of steering and satisfactory tire life. Wheel alignment measurements and adjustments must be made with the front wheels on the ground and supporting the weight of the vehicle.

1. Toe-In

Wheel toe-in is the amount which the wheels point inward at the front and is necessary to offset tire wear due to axle camber. Toe-in is the difference between dimensions A & B as measured from center of tread at wheel center height (Figure 1) while wheels are in a straight ahead position and after vehicle has been moved forward to take up play in the steering connections.

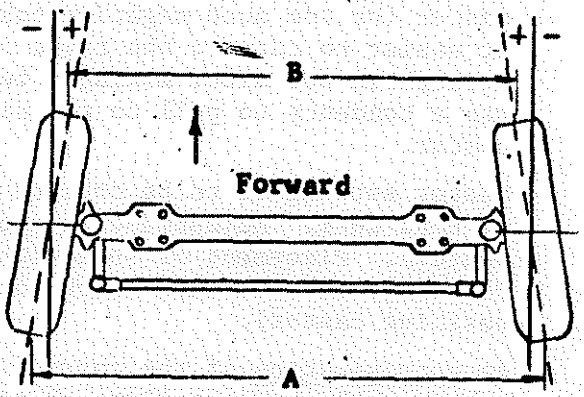


Fig. 1

Toe in as adjusted by lengthening or shortening the tie rod. Following adjustment, tighten the tie rod clamp pinch bolts per 33-10105.

2. Wheel Camber

Front wheel camber is the sideways tilt of the wheels from the vertical. Positive camber is outward tilt and negative camber is inward tilt (Figure 2). Excessive positive camber causes excess tire wear on the outside shoulder of the tire and is usually caused by bent axle parts. Tire wear on inside shoulder of tire, wandering or hard steering, may be caused by excess negative camber which is usually caused by loose wheel bearings or axle parts.

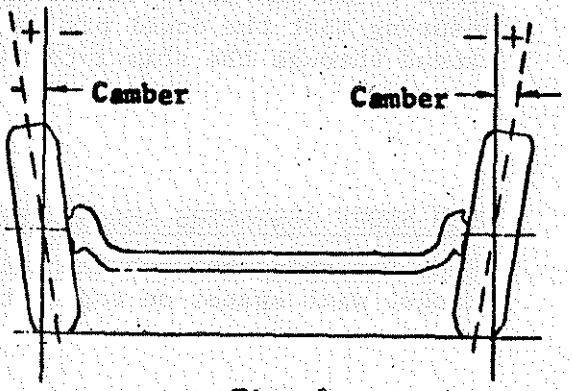
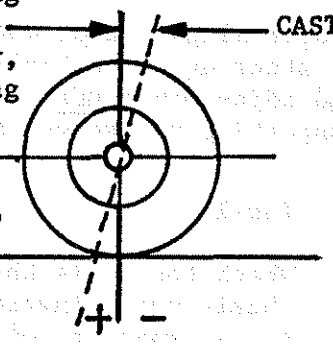


Fig. 2

Camber is set by the axle manufacturer and is not adjustable.

3. AXLE CASTER

Caster is the amount of fore and aft tilt of the king pin with respect to the ground and is measured in degrees. When top of king pin is tilted to the rear, caster is positive (Figure 3). Difficulty in keeping the vehicle from wandering when going straight ahead may be the result of too little caster (or too much negative caster), making it easier to turn to the right or left but harder to straighten out after making a turn. The vehicle has a tendency to pull to the side having the less caster.

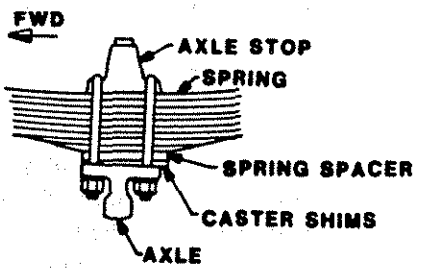


Caster setting is to be checked and adjusted after vehicle assembly and prior to road test. Adjustment is accomplished by the use of caster shims (metal wedges). Placement of shim with thick edge to rear adds positive caster. Placement of shim with thick edge forward adds negative caster (or decreases positive caster).

An approximation of the correct setting can be made at the time of axle sub-assembly by installing shims as shown in the caster specification chart on Page 3. Caster settings are to vary no more than ½ degree from side to side.

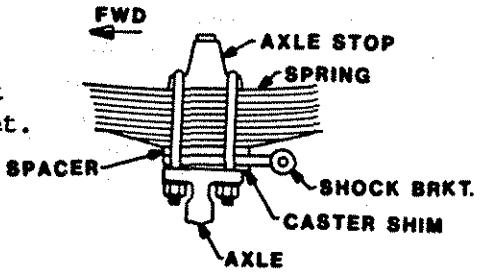
WITHOUT SHOCK ABSORBERS

Place shims between axle and spring spacer insuring that the dowel pin is long enough to extend through the shim into the spacer.



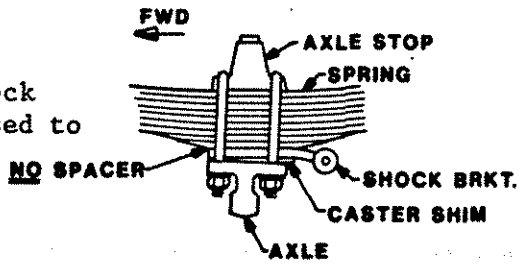
WITH SHOCK ABSORBERS AND SPACERS

Place the shims between the axle and the shock bracket with spacer on top of the shock bracket.



WITH SHOCK ABSORBERS AND NO SPACERS

Place the shims between the axle and the shock bracket. An offset shock bracket must be used to clear the spring assembly.



AXLE MODEL	RATED LOAD CASTER SPECIFICATIONS		INITIAL * CASTER SHIMS		TOE IN (INCHES)
	MANUAL STEERING	POWER STEERING	MAN. STEER.	PWR. STEER.	
B ALL	1 3/4° to 2 3/4°	3° to 4 1/2°	1 1/2°	2 1/2°	0 - 1/16"

B

As long as one side of the front axle caster reading falls within the spec limits in the shop practice and the other side is within 1/2 degree, the caster readings are acceptable.

When loaded to rated capacity, front springs are designed so that spring seats will be parallel to the frame rails. The initial caster shim suggestions are based on a level frame at rated load.

Frame slope and spring deflection will affect caster

1. A frame slope of 1 degree (1" in 57") at rated load will change the caster by 1 degree; down at front decreases positive caster, up at front increases positive caster.

2. Positive caster decreases as spring deflects under load. The caster change from tare condition to rated load is approximately ½ degree.

Compiled	K. HADDOCK	SHOP PRACTICE	33-10105
Approved	KRH	STEERING CROSS TUBE ADJUSTMENT, TIE ROD	
Issued	4-28-66		PAGE 1
Revised	04/27/89 Chg Ltr D	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2006-34

END ASSEMBLY POSITIONING ON TIE ROD

Steering cross tube end assemblies must be parallel on vehicles without power steering. (For vehicles with power steering, see 33-14106, p. 6)

To make this adjustment, simply loosen both the rod end clamps, then turn the sockets by hand (or with pliers) as necessary to align them. Finally, re-tighten both clamps and torque the clamp pinch bolt nuts as follows:

AXLE	TIE-ROD CLAMP PINCH BOLT NUT TORQUE		
EATON EFA-12F4	45 - 60FT - LB		
ROCKWELL	BOLT SIZE	PLAIN NUT	LOCKNUT
ALL MODELS	5/16 - 24	85-115IN-LB	75-100IN-LB
	3/8 - 24	18-24FT-LB	15-20FT-LB
	7/16 - 20	35-50FT-LB	30-40FT-LB
	1/2 - 20	40-55FT-LB	35-50FT-LB
	5/8 - 18	50-65FT-LB	40-55FT-LB
	5/8 - 11	----	40-60FT-LB
	3/4 - 10	----	120-165FT-LB
F/L FK-132	46 - 50FT - LB		

CAUTION:

OVER torquing can be just as detrimental as UNDER torquing the tie-rod clamp pinch bolt. Over torquing causes deformation of the clamp with possible resultant loss of joint integrity.

COMPILED	D R
APPRV	DRS
ISSUE DATE	03/11/87
REV DATE	07/29/96
CHG LTR	D

SHOP PRACTICE

INSTALLATION OF HALDEX AUTOMATIC SLACK ADJUSTERS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-10106
PAGE 1 OF 1
PA2042-72

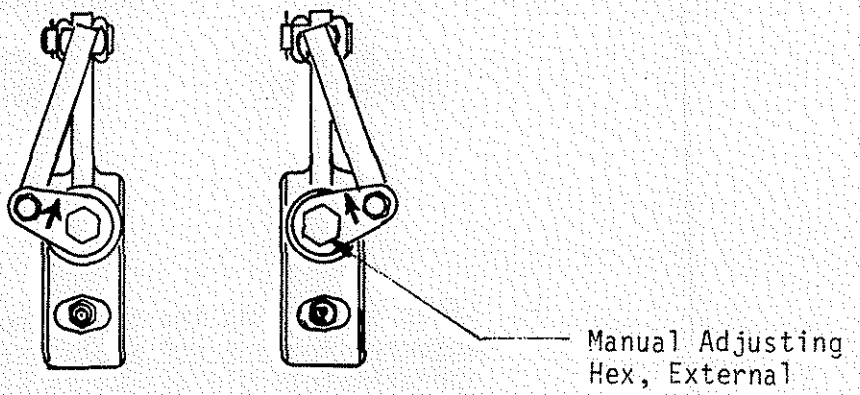
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-005 FOR AUTO SLACK ADJUSTER.

Compiled	N. SAMPSON	SHOP PRACTICE AUTOMATIC SLACK ADJUSTER	33-10106
Approved	DRS		
Issued	3-11-87		
Revised	6-25-87	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

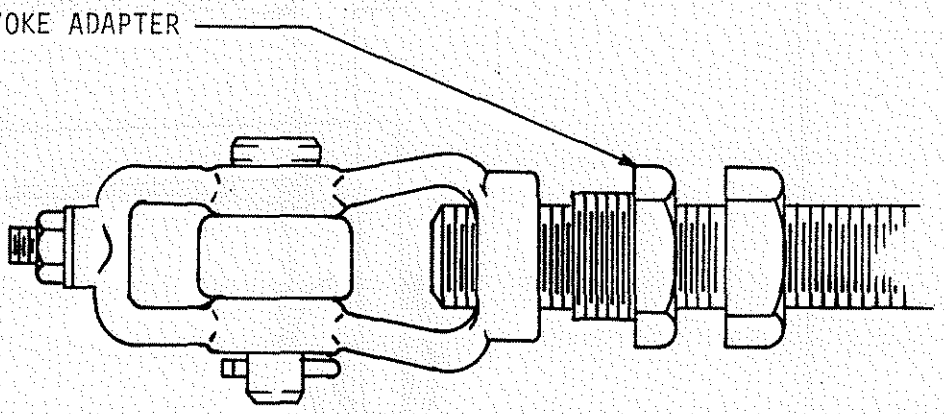
1. ROCKWELL
   Install as per 33- 11118

2. BENDIX
   A. Install slack adjuster on the foundation brake cam shaft.

   B. Turn the external adjusting hex, in the direction indicated by the arrow on the crank arm, until the brake chamber push rod enters the slack adjuster yoke assembly. The end of the brake chamber push rod should enter the yoke assembly and be even with the surface of the throat of the yoke.



   C. Run the Sure Stroke yoke adapter up the brake chamberpush rod until it enters the yoke assembly fully and tightens.



2. BENDIX (CONT.)

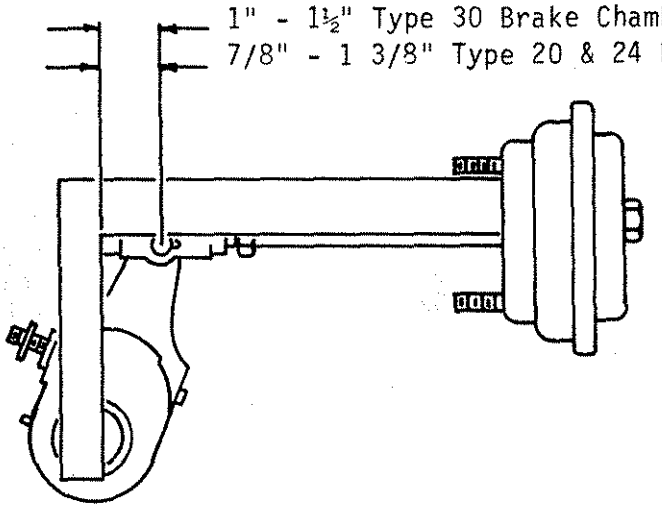
D. Run the brake chamber push rod lock nut up to the yoke adapter and tighten it.

E. After installing the Sure Stroke, Adjust the brakes manually using the external adjusting hex. Check the manual adjustment by observing that the brake chamber stroke is less than the recommended adjustment stroke for the brake chamber and that the brake is completely free in the released position (see table below). No further manual adjustment will be necessary.

STROKE TABLE

BRAKE CHAMBER SIZE	RECOMMENDED ADJUSTMENT STROKE
30	2"
24	1-3/4"
20	1-3/4"

F. After installing the Sure Stroke check that the arm of the slack adjuster forms a 90° angle with the brake chamber push rod at approximately mid-stroke of the brake chamber.



A ↓

3. HALDEX

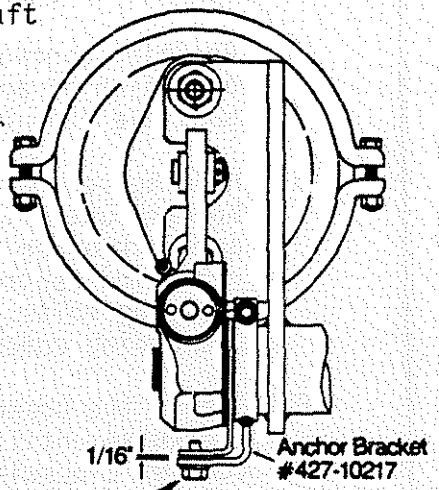
Front axle unit with slotted control arm.

A. Loosely install anchor bracket onto cam shaft tube, Figure #1.

B. With manual adjusting nut pointing away from brake chamber, assemble slack adjuster onto camshaft splined end so that the lever arm clears the clevis on the air chamber push rod. Use camshaft spacing washers to align slack adjuster with centerline of air chamber. Secure slack adjuster on the camshaft by assembling spacing washers and snap ring.

C. Using a 7/16" wrench, turn the manual adjusting nut clockwise to move the slack adjuster toward to the clevis and at the same time assist the control arm stud to enter the anchor strap slot by slightly bending the strap to clear the stud and aligning the slot with the stud. When the stud is in the strap slot, continue to turn adjusting nut until the clevis pin holes in the slack adjuster and clevis are perfectly aligned. Install clevis pin and secure with a cotter pin.

CAUTION: All Freightliner cam brakes, both front and rear are to use the



'A' Anchor Bolt
Figure #1

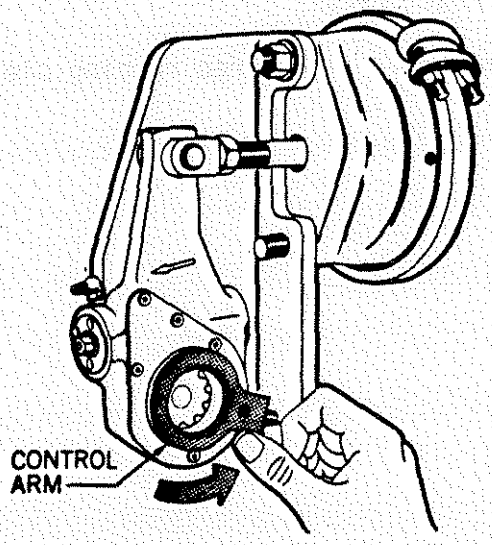
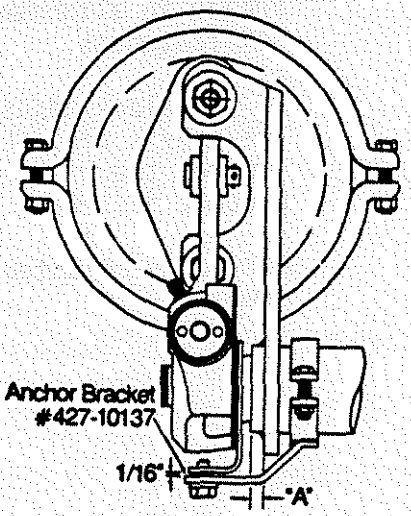


Figure #2



Alternate Bracket

3. HALDEX (cont'd)

5.50 slack adjuster length.

D. Position control arm in its full released position by forcing it in direction of arrow "A" (toward brake chamber) until it comes to a positive stop (inside slack adjuster). Do not hammer on control arm.

E. Holding control arm in full released position (Figure 2), turn anchor bracket until it aligns with control arm slot. Thread anchor bolt A, and lockwasher through bracket and into control arm and tighten. While retaining control arm in full released position, tighten anchor bracket mounting bolts. 1/16" clearance is required at Point B to avoid preloading control arm.

F. Adjust the brake lining clearance by turning the adjustment hex nut clockwise until the brake lining meets the brake drum, then back off counter clockwise 3/4 of a turn. (A ratcheting sound can occur).

G. Final Check - Control location.

IMPORTANT - Check installation by removing clevis pin. Push the slack adjuster into the clevis. If the slack adjuster hole and clevis pin hole remain in alignment on release, the installation is properly made. Secure all fasteners.

If the slack adjuster hole is not aligned with the clevis pin hole, replace the clevis pin. Loosen the control arm fasteners and move the control arm towards the brake chamber until it comes to a definite stop. Tighten the bracket fasteners. Repeat the final check.

Correctly adjusted slack adjusters will allow free running clearance to drum.

Compiled	F.Freer	SHOP PRACTICE	33-10107
Approved	DEJ	FRONT AXLE ATTACHMENTS	
Issued	1-19-70	Chg Ltr A **FREIGHTLINER CORPORATION** PORTLAND, OREGON	P*A078-18
Revised	6-5-78		

1. GENERAL: No device, mechanism or other attachment **shall** be made to any part of the front axle or its mounting parts **except** in a manner prescribed in writing by Corporate Engineering.

   Devices approved (by Corporate Engineering) may be installed only in the manner described by Corporate Engineering. Frequently the mounting instructions coincide with the manfactuers directions but do not assume that such is always the case. As Freightliner Corporation carries the service and liability responsibilities for the entire vehicle, the mounting instructions must always be reviewed to insure compatibility with our other equipment.

2. WELDING: No welding may be performed on any part of the front axle or its attachments without written authority of the Chief Engineer.

REVISED & RETYPED 'A' CHANGE

COMPILED	K H
APPRV	IJW
ISSUE DATE	04/07/65
REV DATE	07/29/96
CHG LTR	G

SHOP PRACTICE

INSTALLATION-OIL SEALS FRONT AND REAR AXLES

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-10108

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-006 FOR FRONT AND REAR AXLE OIL SEALS.

COMPILED	K. HADDOCK
APPRV	IJW
ISSUE DATE	04/07/65
REV DATE	09/19/94
CHG LTR	F

SHOP PRACTICE

INSTALLATION - OIL SEALS ,FRONT AND REAR AXLES

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-10108
PAGE 1 OF 4
PA2101-06

1. CHICAGO RAWHIDE (SCOTSEAL)

THE SCOTSEAL IS A ONE PIECE INSTALLATION. ALL RELATIVE MOTION IS WITHIN THE SEAL ITSELF, THE SEAL IS STATIONARY WITH RESPECT TO THE HUB AND SPINDLE.

NOTE: SCOTSEALS ARE TO BE INSTALLED DRY. NO SEALANT OR LUBRICATION IS REQUIRED AT ASSEMBLY.

1.1 INSTALLATION OF REAR AXLE OIL SEALS UTILIZING A DUAL RAM PRESS.

F 1.1.1 ENSURE PRESS FORCE IS BELOW 5000 LBS MAX FORCE (OIL PRESSURE X CYLINDER AREA)

1.1.2 MAKE SURE THAT UPPER AND LOWER PRESS DETAILS ARE CLEAN AND FREE FROM DIRT TO PREVENT DAMAGE OF SEALS OR BEARING RACES.

1.1.3 PLACE SEAL TO LOWER SEAT OF PRESS TOOLING.

1.1.4 PLACE BEARING TO SPRING LOADED BEARING REST OF PRESS TOOLING.

1.1.5 POSITION HUB ASSEMBLY OVER THE LOWER PRESS TOOLING.

1.1.6 ACTIVATE THE PRESS TO EXTEND UPPER AND LOWER RAM UNTIL PRESS STOPS.

1.1.7 RETRACT PRESS CYLINDERS.

1.1.8 REMOVE THE HUB/SEAL ASSEMBLY FROM THE PRESS.

1.2 INSTALLATION OF FRONT AXLE OIL SEALS UTILIZING A SINGLE RAM PRESS.

F 1.2.1 ENSURE PRESS FORCE IS BELOW 5000 LBS MAX FORCE (OIL PRESSURE X CYLINDER AREA).

1.2.2 TURN HUB ASSEMBLY OVER TO A SEAL UP POSITION.

1.2.3 PLACE BEARING TO INNER HUB BEARING RACE.

1.2.4 POSITION SEAL TO RECESS OF HUB.

1.2.5 SELECT PROPER ADAPTOR RING FOR SEAL SIZE AND PLACE TO SEAL.

1.2.6 POSITION HUB UNDER SINGLE RAM OF PRESS.

1.2.7 ACTUATE PRESS RAM TO PRESS SEAL INTO PLACE.

1.2.8 RETRACT PRESS RAM.

1.2.9 TURN HUB ASSEMBLY OVER TO SEAL DOWN POSITION.

1.3 OPTIONAL OIL SEAL INSTALLATION WITH MANUAL TOOLING.

1.3.1 SELECT PROPER CHICAGO RAWHIDE TOOL.

1.3.2 MAKE SURE THAT INSTALLATION TOOL, BEARING RACE AND SEAL ARE FREE OF DIRT TO PREVENT DAMAGE TO SEALS OR BEARINGS.

1.3.3 SEAT SMALLER O.D. OF SEAL IN RECESS OF INSTALLATION TOOL.

1.3.4 INSERT CENTERING PLUG OF TOOL IN BORE OF INNER BEARING CONE (THIS PREVENTS COCKING OF THE SEAL IN THE HUB BORE).

1.3.5 HOLD TOOL HANDLE FIRMLY AND STRIKE WITH HAMMER UNTILL SOUND OF IMPACT CHANGES AS SEAL BOTTOMS OUT. HOLD TOOL FIRMLY TO AVOID BOUNCE OR UNSEATING OF THE SEAL FROM TOOL.

1.3.6 AFTER SEAL IS BOTTOMED IN BORE, CHECK FOR PROPER INSTALLATION OF SEAL. A SLIGHT SIDE TO SIDE MOVEMENT OF THE INNER RUBBER COMPONENT OF THE SEAL INDICATES A DAMAGE FREE INSTALLATION.

1.3.7 WHEN STARTING THE HUB ASSEMBLY ON THE AXLE SPINDLE, CENTER THE HUB CAREFULLY TO AVOID SEAL DAMAGE FROM THE LEADING EDGE OF THE SPINDLE.

2. NATIONAL SEALS

THE NATIONAL SEAL IS A ONE PIECE SEAL.

NOTE: NO SEALANTS ARE TO BE USED WITH THIS SEAL DURING INSTALLATION. THE O.D. OF THE SEAL IS TO BE LUBRICATED WITH A LIGHT OIL FILM PRIOR TO INSTALLATION TO HUB.

2.1 INSTALLATION OF REAR AXLE OIL SEALS UTILIZING A DUAL RAM PRESS.

F 2.1.1 ENSURE PRESS FORCE IS BELOW 4000 LBS MAX FORCE (OIL PRESSURE X CYLINDER AREA).

2.1.2 SELECT THE PROPER STOP RING FOR THE HUB AND SEAL USED.

2.1.3 MAKE SURE THAT UPPER AND LOWER PRESS DETAILS ARE CLEAN AND FREE FROM DIRT TO PREVENT DAMAGE OF SEALS OR BEARING RACES.

2.1.4 PLACE SEAL IN RECESS OF THE ADAPTOR TOOL.

2.1.5 PLACE BEARING TO SPRING LOADED BEARING REST OF PRESS TOOLING.

2.1.6 POSITION HUB ASSEMBLY OVER LOWER PRESS TOOLING.

2.1.7 ACTIVATE PRESS TO EXTEND UPPER AND LOWER RAM UNTIL PRESS STOPS (THE STOP RING WILL LIMIT THE INSTALLATION DEPTH TO PREVENT OVER PRESSING THE SEAL).

2.1.8 RETRACT PRESS CYLINDER.

2.1.9 REMOVE HUB/SEAL ASSEMBLY FROM THE PRESS.

2.2 INSTALLATION OF FRONT AXLE OIL SEALS UTILIZING A SINGLE RAM PRESS.

F 2.2.1 ENSURE PRESS FORCE IS BELOW 4000 LBS MAX FORCE (OIL PRESSURE X CYLINDER AREA).

2.2.2 TURN HUB ASSEMBLY OVER TO A SEAL UP POSITION.

2.2.3 PLACE BEARING TO INNER HUB BEARING RACE.

2.2.3.1 NOTE: CLASS 6/7 FRONT BEARINGS ARE TO BE PACKED WITH GREASE BEFORE PLACING IN THE HUB BEARING RACE (UNLESS OIL BATH IS SPECIFIED ON THE VEHICLE SPECIFICATION).

2.2.4 SELECT PROPER ADAPTOR RING FOR SEAL SIZE.

2.2.5 POSITION SEAL TO RECESS OF SEAL ADAPTOR.

2.2.6 POSITION HUB UNDER SINGLE RAM OF PRESS, ALIGNING BEARING PILOT WITH THE BEARING I.D.

2.2.7 ACTUATE PRESS RAM TO PRESS SEAL INTO PLACE.

2.2.8 RETRACT PRESS RAM AND REMOVE SEAL ADAPTOR.

2.2.9 TURN HUB ASSEMBLY OVER TO SEAL DOWN POSITION.

2.3 OPTIONAL OIL SEAL INSTALLATION WITH MANUAL TOOLING.

2.3.1 SELECT PROPER NATIONAL SEAL INSTALLATION TOOL CONSISTING OF HANDLE, ADAPTOR PLATE, AND BEARING PILOT.

2.3.2 MAKE SURE THAT INSTALLATION TOOL, BEARING RACE, AND SEAL AREA ARE FREE FROM DIRT TO PREVENT DAMAGE TO SEALS OR BEARING RACES.

2.3.3 PLACE SEAL TO INSTALLATION TOOL WITH THE WORDS "AIR SIDE" FACING TOWARD ADAPTOR PLATE.

2.3.4 INSERT BEARING PILOT OF TOOL INTO INNER BEARING CONE.

2.3.5 HOLD TOOL STRAIGHT AND DRIVE SEAL INTO HUB. WHEN SEAL IS FULLY SEATED, THE SOUND OF IMPACT WILL CHANGE.

2.3.6 CHECK TO SEE THAT THE SEAL IS SQUARELY IN POSITION AND THAT THE INNER BEARING ROTATES FREELY.

2.3.7 APPLY A THIN FILM OF CLEAN OIL TO THE RUBBER RIBS ON THE SEAL I.D. BEFORE INSTALLING HUB TO AXLE SPINDLE.

F

3. EATON/FREUDENBERG-NOK

THE EATON SEAL IS A ONE PIECE SEAL.

NOTE: NO SEALANTS ARE TO BE USED WITH THIS SEAL DURING INSTALLATION. THE I.D.AND O.D. OF THE SEAL IS TO BE LUBRICATED WITH A LIGHT OIL FILM PRIOR TO INSTALLATION TO HUB. SEALS COME FROM VENDOR READY TO INSTALL.

3.1 INSTALLATION OF REAR AXLE OIL SEALS UTILIZING A DUAL RAM PRESS.

3.1.1 ENSURE PRESS FORCE IS BELOW 2000 LBS MAX FORCE (OIL PRESSURE X CYLINDER AREA).

3.1.2 SELECT THE PROPER STOP RING FOR THE HUB AND SEAL USED.

3.1.3 MAKE SURE THAT UPPER AND LOWER PRESS DETAILS ARE CLEAN AND FREE FROM DIRT TO PREVENT DAMAGE OF SEALS OR BEARING RACES.

3.1.4 PLACE SEAL IN RECESS OF THE ADAPTOR TOOL.

3.1.5 PLACE BEARING TO SPRING LOADED BEARING REST OF PRESS TOOLING.

3.1.6 POSITION HUB ASSEMBLY OVER LOWER PRESS TOOLING.

3.1.7 ACTIVATE PRESS TO EXTEND UPPER AND LOWER RAM UNTIL PRESS STOPS (THE STOP RING WILL LIMIT THE INSTALLATION DEPTH TO PREVENT OVER PRESSING THE SEAL).

3.1.8 RETRACT PRESS CYLINDER.

3.1.9 REMOVE HUB/SEAL ASSEMBLY FROM THE PRESS.

3.2 INSTALLATION OF FRONT AXLE OIL SEALS UTILIZING A SINGLE RAM PRESS.

3.2.1 ENSURE PRESS FORCE IS BELOW 2000 LBS MAX FORCE (OIL PRESSURE X CLINDER AREA).

3.2.2 TURN HUB ASSEMBLY OVER TO A SEAL UP POSITION.

3.2.3 PLACE BEARING TO INNER HUB BEARING RACE.

3.2.3.1 NOTE: CLASS 6/7 FRONT BEARINGS ARE TO BE PACKED WITH GREASE BEFORE PLACING IN THE HUB BEARING RACE (UNLESS OIL BATH IS SPECIFIED ON THE VEHICLE SPECIFICATION).

3.2.4 SELECT PROPER ADAPTOR RING FOR SEAL SIZE.

3.2.5 POSITION SEAL TO RECESS OF SEAL ADAPTOR.

3.2.6 POSITION HUB UNDER SINGLE RAM OF PRESS, ALIGNING BEARING PILOT WITH THE BEARING I.D.

3.2.7 ACTUATE PRESS RAM TO PRESS SEAL INTO PLACE.

3.2.8 RETRACT PRESS RAM AND REMOVE SEAL ADAPTOR.

3.2.9 TURN HUB ASSEMBLY OVER TO SEAL DOWN POSITION.

3.3 OPTIONAL OIL SEAL INSTALLATION WITH MANUAL TOOLING.

3.3.1 SELECT PROPER NATIONAL SEAL INSTALLATION TOOL CONSISTING OF HANDLE, ADAPTOR PLATE, AND BEARING PILOT.

3.3.2 MAKE SURE THAT INSTALLATION TOOL, BEARING RACE, AND SEAL AREA ARE FREE FROM DIRT TO PREVENT DAMAGE TO SEALS OR BEARING RACES.

3.3.3 PLACE SEAL TO INSTALLATION TOOL WITH THE WORDS "AIR SIDE" FACING TOWARD ADAPTOR PLATE.

3.3.4 INSERT BEARING PILOT OF TOOL INTO INNER BEARING CONE.

3.3.5 HOLD TOOL STRAIGHT AND DRIVE SEAL INTO HUB. WHEN SEAL IS FULLY SEATED, THE SOUND OF IMPACT WILL CHANGE.

3.3.6 CHECK TO SEE THAT THE SEAL IS SQUARELY IN POSITION AND THAT THE INNER BEARING ROTATES FREELY.

3.3.7 APPLY A THIN FILM OF CLEAN OIL TO THE RUBBER RIBS ON THE SEAL I.D. BEFORE INSTALLING HUB TO AXLE SPINDLE.

4. STEMCO SEALS

THE STEMCO SEAL IS A ONE PIECE INSTALLATION. ALL RELATIVE MOTION IS WITHIN THE SEAL ITSELF. THE STEMCO GUARDIAN AND STEMCO SS4 SEALS ARE UNIQUE IN THAT THE SEAL IS INSTALLED TO THE AXLE SPINDLE AND NOT TO THE HUB BORE AS OTHER SEALS ARE.

4.1 INSTALLATION WITH MANUAL STEMCO INSTALLATION TOOLS.

4.1.1 SELECT PROPER STEMCO INSTALLATION TOOL.

4.1.2 MAKE SURE THAT INSTALLATION TOOL AND AXLE SPINDLE SEAL AREA ARE FREE FROM DIRT TO PREVENT DAMAGE TO THE SEALS.

4.1.3 APPLY A THIN LAYER OF SEALANT TO THE SEAL AREA OF THE AXLE HOUSING SPINDLE.

4.1.4 PLACE THE SEAL ASSEMBLY ON THE SPINDLE SO THAT THE WORDS "OIL BEARING SIDE" ARE FACING THE OUTBOARD END OF THE AXLE SPINDLE.

4.1.5 PLACE THE STEMCO INSTALLATION TOOL OVER THE AXLE SPINDLE AND AGAINST THE SEAL. DRIVE THE SEAL OVER THE SPINDLE UNTIL THE TOOL BOTTOMS OUT AGAINST THE SPINDLE SHOULDER. ROTATE THE TOOL AND TAP SEVERAL TIMES TO ENSURE THAT THE SEAL IS SQUARELY SEATED.

4.1.6 WIPE AWAY ALL EXCESS SEALANT.

4.1.7 PRELUBE INNER BEARING AND PLACE TO AXLE SPINDLE.

4.1.8 BE CAREFUL DURING INSTALLATION OF HUB TO CENTER HUB ON SPINDLE TO PREVENT DAMAGE TO EITHER THE BEARING OR THE SEAL.

F

5. MIDLAND/MECHANEX (BARRIER PLUS)

THE MIDLAND SEAL IS A ONE PIECE INSTALLATION. ALL RELATIVE MOTION IS WITHIN THE SEAL ITSELF. THE SEAL IS STATIONARY WITH RESPECT TO THE HUB AND SPINDLE.

5.1 INSTALLATION BY HAND PUSH ON (NO SPECIAL TOOLS)

5.1.1 THOROUGHLY CLEAN GREASE FROM SPINDLE.

5.1.2 LIGHTLY LUBRICATE THE SEAL O.D. AND I.D. EVENLY WITH OIL AND A THIN LAYER ON THE HUB BORE THAT THE SEAL IS BEING PRESSED INTO (NEVER INSTALL DRY).

5.1.3 PRESS THE SEAL BY HAND EVENLY INTO THE BORE. A RUBBER MALLET OR SOFT FACED TOOL MAY BE USED TO GNTLY TAP THE SEAL INTO PLACE.

5.1.4 BE SURE THAT THE SEAL IS EVENLY SEATED AND BOTTOMED IN THE BORE.

5.1.5 BE CAREFUL DURING INSTALLATION OF HUB TO CENTER HUB ON SPINDLE TO PREVENT COCKING SEAL.

COMPILED	K H	SHOP PRACTICE DUST SHIELD INSTALLATION	SECTION NUMBER 33-10109
APPRV	D R S		PAGE 1 OF 1
ISSUE DATE	01/26/83		
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-007 FOR DUST SHIELD INSTALLATION PROCEDURE.

A. EATON - ESA 1540 STEER AXLE BRAKES, ONE PIECE DUSTSHIELD

1. Place the brake assembly on a horizontal surface with the edge of the brake shoes flat on the surface and the air chamber bracket up.

2. Place four nutserts in their respective holes in the spider.

3. Pass dustshield over air chamber bracket and place dustshield lip (at cam bracket end) under the stabilizing screw. Align the dustshield holes with the four nutserts (see Figure 1).

4. Fasten the dustshield to the brake spider by placing the dustshield screws through the dustshield and into the nutserts (Step 1, Figure 2). Place light downward pressure on the air gun and tighten the dustshield screws to 11-15 ft-lbs. This will both set the nutsert in the spider and attach the dustshield (Step 2, Figure 2).

   Caution: An engineered interference has been built into the dustshield at the cam bracket end of the brake for increased dustshield stiffness. A slight push may be necessary to make the dustshield surface - X parallel to the spider mounting surface -Z.

FIGURE 1

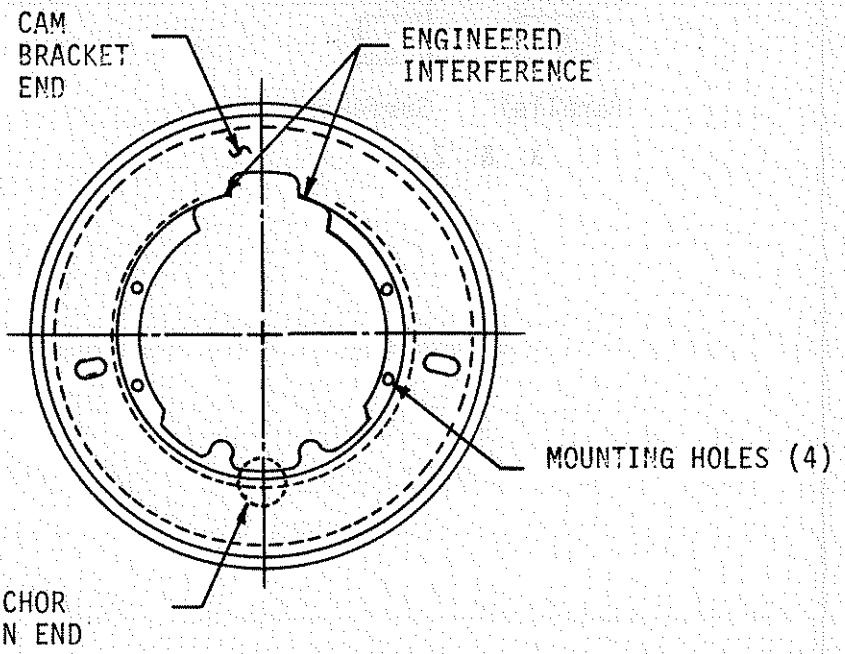
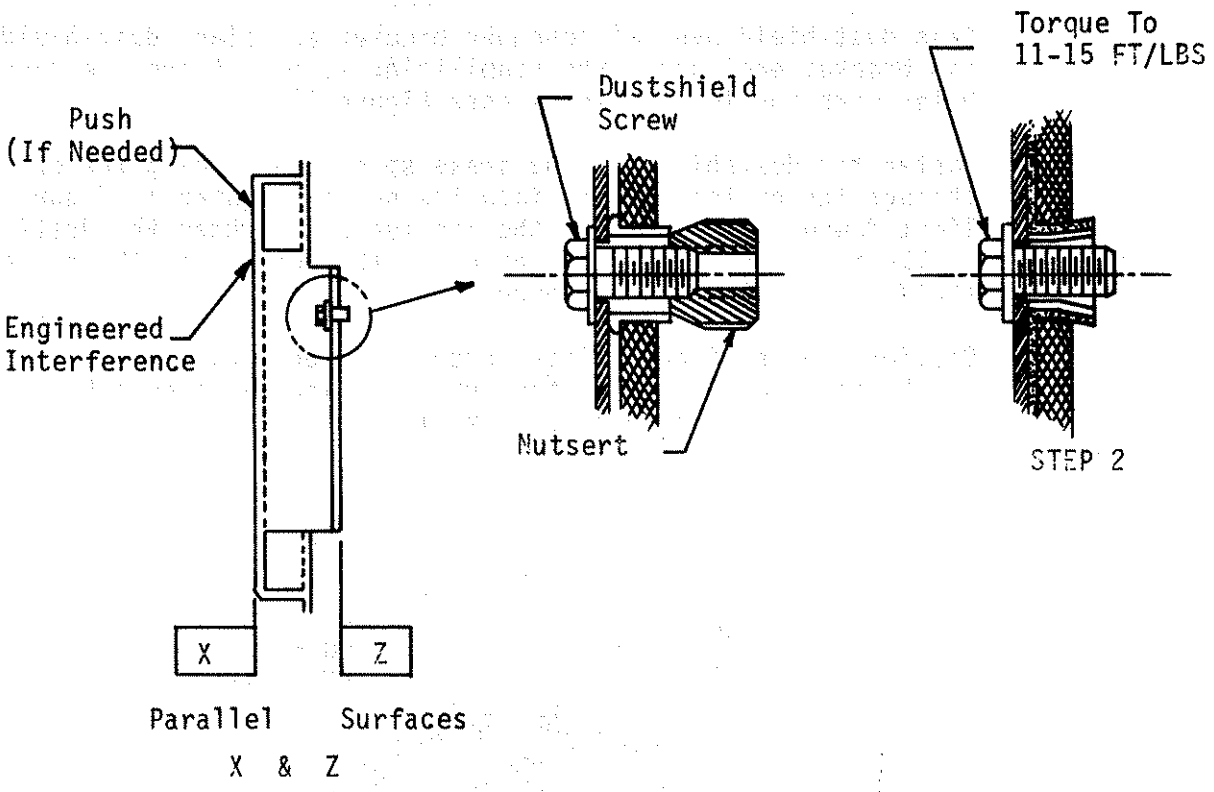


FIGURE 2


Push
(If Needed)
Engineered
Interference
X
Z
Parallel Surfaces
X & Z
Dustshield
Screw
Nutsert
Torque To
11-15 FT/LBS
STEP 2

COMPILED	K H	SHOP PRACTICE	SECTION NUMBER
APPRV	DRS	FRONT AXLE LUBRICATION	33-10110
ISSUE DATE	04/07/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	H		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-008 FOR FRONT AXLE LUBRICATION.

Compiled	K. HADDOCK	SHOP PRACTICE	33-10110
Approved	DRS	FRONT AXLE LUBRICATION	
Issued	4-7-65		Page 1 of 2
Revised	6-9-84	Chg Ltr G FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-18

C

1. FRONT HUB LUBRICATION

All front hubs are oil lubricated. Fill hub with oil per vehicle lubrication chart, 33-00102, to the proper level indicated on the hub cap.

D

2. TIE-ROD END LUBRICATION

All front axles are standard with greaseable type tie-rod ends.

A. Rockwell front axles - Tie-rod ends on Rockwell front axles are not to be lubricated at our plants. These tie-rod ends are pre-lubricated with a special break-in lubricant and should remain for the initial 50,000 miles.

B. Eaton Front Axle (EFA-12F4) - Lubricate tie-rod ends with multi-purpose chassis grease 48-00109.

C. Freightliner (GKN) FK-132/FK-120 Front Axle - Lubricate tie-rod ends with multi-purpose chassis grease 48-00109.

3. KING PIN LUBRICATION

A. Freightliner (GKN) FK-132/FK-120 Front Axle - King pins are pre-lubricated and do not require lubrication at our plants.

B. Eaton Front Axle (EFA-12F4) - Lubricate upper and lower king pin bushings with multi-purpose chassis grease 48-00109, with front wheels on the ground.

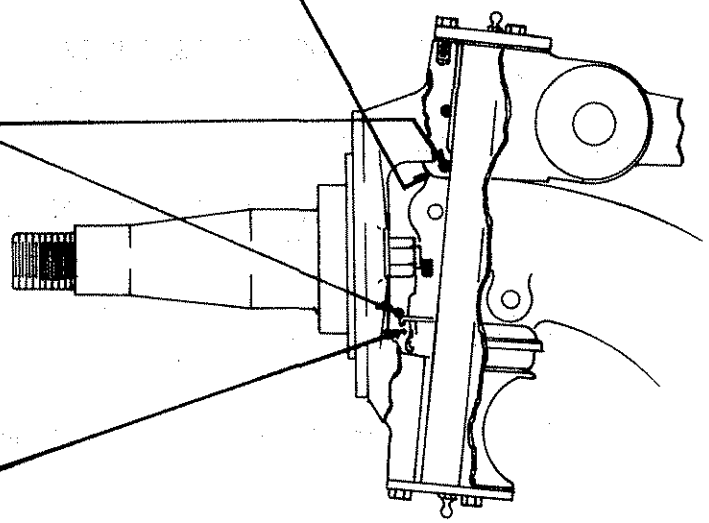
C. Rockwell Front Axles - Lubricate upper and lower king pin bushings with multi-purpose chassis grease 48-00109, with front wheels on the ground.

2. KING PIN, ROK MODEL FF-931 & FF-941

ALWAYS APPLY LUBE PRESSURE UNTIL GREASE COMES OUT HERE.

(EVEN IF GREASE LEAKS OUT AROUND TOP OR BOTTOM PLATE GASKET, KEEP APPLYING PRESSURE UNTIL GREASE COMES OUT PAST SEAL AT END OF BUSHING OPPOSITE GREASE FITTING)

GREASE SEAL WILL BY-PASS GREASE PRESSURE WITHOUT DAMAGING SEAL AND IS DESIGNED TO HAVE GREASE PUMPED OUT THRU IT ON EACH LUBE JOB.



ALWAYS APPLY LUBE PRESSURE UNTIL GREASE COMES OUT HERE.

3. KNUCKLE PIN & TIE ROD END, ROK

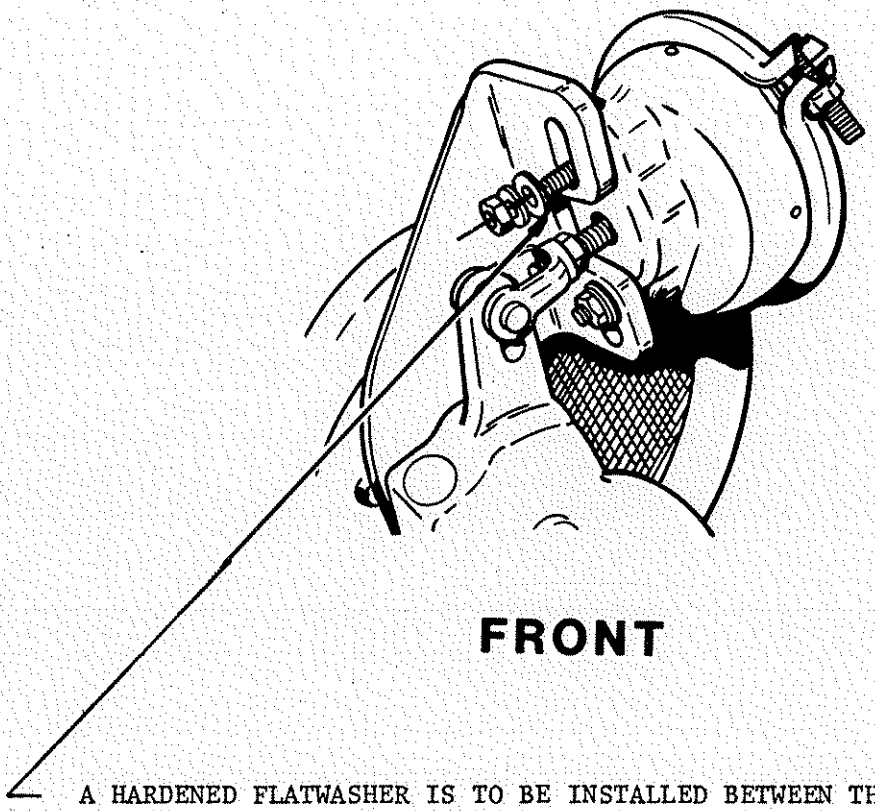
A. ALL EXCEPT FL-941: These axles are to be lubed with the wheels either on or off the ground.

B. FL-941: These axles must be lubed with the wheels off of the ground.

4. EATON FRONT AXLES

No lubrication is necessary unless disassembly, affecting the existing lubrication system, is performed.

Compiled	D. WELKER	SHOP PRACTICE BRAKE CHAMBER INSTALLATION FRONT	33-10111
Approved	D.C.R.		
Issued	1-6-86		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	



FRONT

A HARDENED FLATWASHER IS TO BE INSTALLED BETWEEN THE LOCKWASHER AND THE BRAKE CHAMBER BRACKET.

COMPILED	HJR	SHOP PRACTICE	SECTION NUMBER
APPRV	CHAUNCEY	BRAKE ADJUSTMENT	33-10112
ISSUE DATE	01/19/67		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	D		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-009 FOR BRAKE ADJUSTMENT.

Compiled	H.J.R.	SHOP PRACTICE BRAKE ADJUSTMENT	33-10112
Approved	CHANCEY		
Issued	1-19-67	Chg Ltr C **FREIGHTLINER CORPORATION** PORTLAND, OREGON	P*A078-18
Revised	3-29-76		

A. FRONT CAM TYPE BRAKES WITH ADJUSTABLE ANCHORS

To adjust the brake, jack up the wheel and open the cam until the toes of the shoes touch the brake drum and stop the wheel from spinning. Release just enough to free the wheel, then turn each anchor pin in the same manner, releasing each of them just enough to allow the wheel to turn freely.

This procedure should be followed the second time, and a third, if necessary, to obtain the best brake adjustment possible.

When adjustment of cam and anchors is complete be sure to retighten the anchor lock nuts. When tightening the lock nut, make sure the anchor is held securely.

C B. STOPMASTER (WEDGE) BRAKE ADJUSTMENT PROCEDURE

Although all wedge brakes which Freightliner uses are equipped with automatic adjusters, these brakes must be adjusted manually at time of installation.

The following procedure should be followed: Adjusting bolts have right hand threads. With an adjusting spoon, turn the star-wheel until a heavy drum drag is developed. Then back off the bolt to a very light drag on the drum (try two clicks of the star-wheel). Repeat for other shoe on the brake. Replace dust covers in adjusting slots. Repeat for other brakes.

NOTE: If the lining clearance with the drum is more than .060", they will not adjust automatically.

REVISED & RETYPED "C" CHG

COMPILED	D W	SHOP PRACTICE ROCKWELL DISC BRAKE PAINTING	SECTION NUMBER 33-10113
APPRV	D W		
ISSUE DATE	02/06/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		PA2042-72

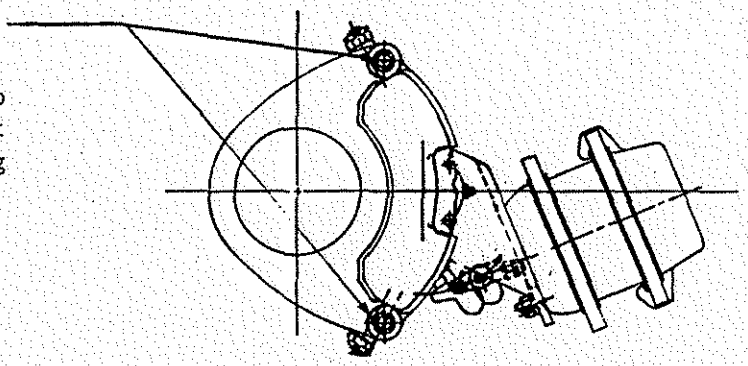
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-010 FOR ROCKWELL DISC BRAKE PAINTING.

Compiled	D. Welker	SHOP PRACTICE ROCKWELL DISC BRAKE PAINTING	33-10113
Approved	D. W.		
Issued	2-6-85		
Revised	9-4-87	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	

ROCKWELL DISC BRAKES:

The only paint sensitive areas on the brake are the slide pins which should remain free of paint. Protect as shown below.

Exposed areas of slide pins must be masked off prior to painting to prevent paint from adhering to pins.



1. U-BOLTS

A. Length

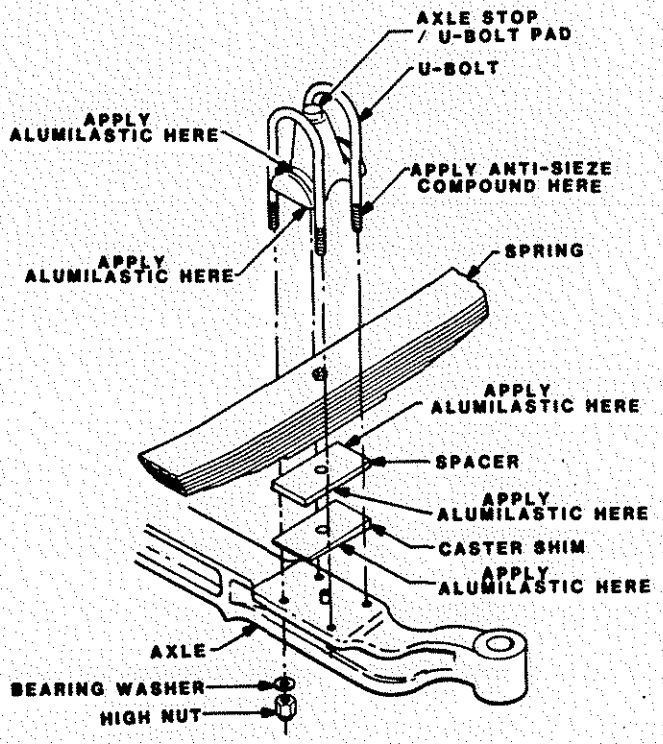
The U-bolt threads are to extend beyond the high nut by a minimum of three (3) threads and a maximum of 1.50" with the nuts fully tightened.

B. Lubricants

The threaded portions of the U-bolt are to be coated with anti-seize compound, 48-00094-101, or chassis lube, 48-00109-001, at the time of assembly. The U-bolt pad is to have alumilastic, 48-00119, applied to the grooves and its base. The caster shim and spacer are to be coated also.

C. Torque

As per 33-11109.



COMPILED	N S
APPRV	DRS
ISSUE DATE	03/11/87
REV DATE	07/29/96
CHG LTR	B

SHOP PRACTICE

INSTALLATION OF ROCKWELL AUTOMATIC SLACK ADJUSTER

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-10115

PAGE
1 OF 1

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-011 FOR ROCKWELL AUTO/SLACK ADJUSTER INSTALLATION.

COMPILED	N. SAMPSON
APPRV	DRS
ISSUE DATE	03/11/87
REV DATE	01/19/96
CHG LTR	A

SHOP PRACTICE

INSTALLATION OF ROCKWELL AUTOMATIC SLACK ADJUSTER

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-10115

PA2042-64

PURPOSE:

TO PROVIDE A PROCEDURE FOR THE INSTALLATION OF ROCKWELL AUTOMATIC SLACK ADJUSTERS AT TRUCK ASSEMBLY.

ABSTRACT:

THIS STANDARD DEFINES A DETAILED PROCEDURE FOR FRONT AXLE INSTALLATION OF 5 1/2 INCH ROCKWELL AUTOMATIC SLACK ADJUSTERS (ASA'S) TO ROCKWELL OR EATON CAM BRAKE ASSEMBLIES.

SCOPE:

THIS SHOP PRACTICE PRESCRIBES FREIGHTLINER'S REQUIREMENT FOR THE ASSEMBLY OF ROCKWELL AUTOMATIC SLACK ADJUSTERS TO EATON AND ROCKWELL CAM BRAKE ASSEMBLIES, INCLUDING PROCEDURES, THE INITIAL SETTINGS, AND OPERATING CONDITIONS. THE PRACTICE SHALL BE IN EFFECT IN THE ABSENCE OF SPECIFIC ENGINEERING DIRECTION.

RESPONSIBILITY:

ALL PERSONNEL RESPONSIBLE FOR THE INSTALLATION OF, OR THE ACCEPTANCE OF, ROCKWELL AUTOMATIC SLACK ADJUSTERS FITTED TO EATON OR ROCKWELL CAM BRAKE ASSEMBLIES SHALL BE RESPONSIBLE FOR ADHERENCE TO THIS PROCEDURE.

SPECIFICATION:

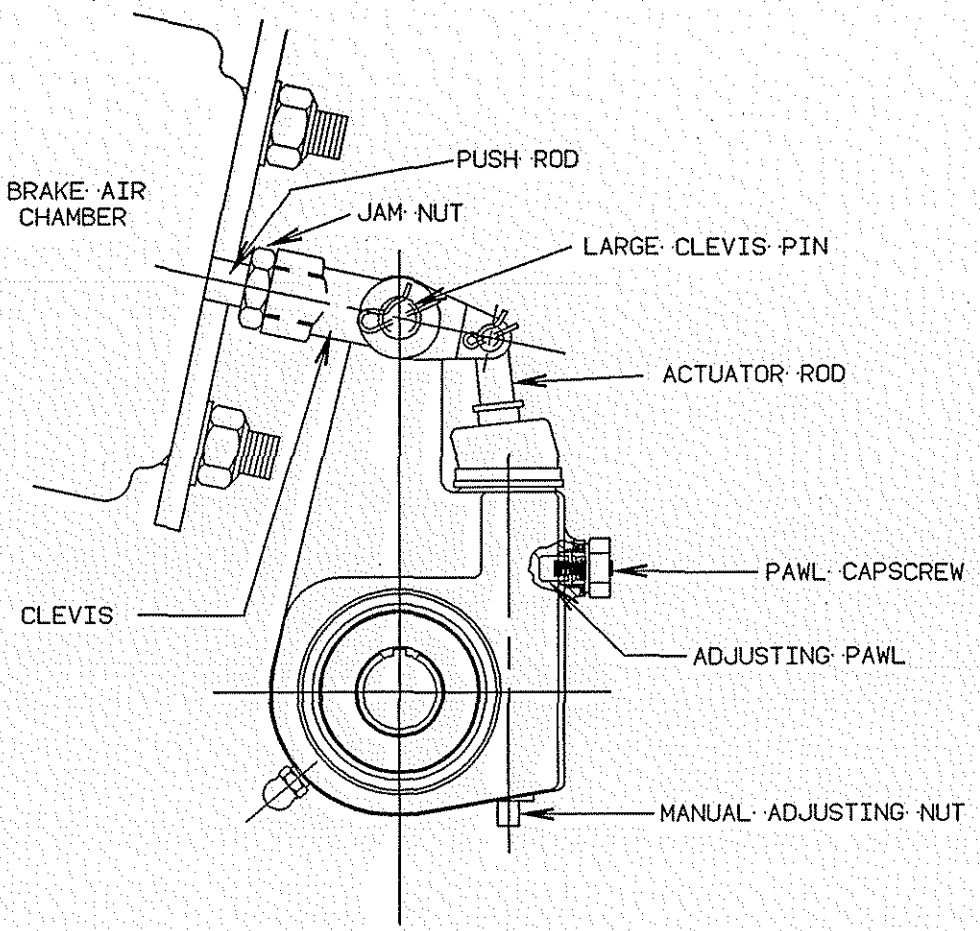
1. PRECAUTIONARY MEASURES

1.1 IT IS IMPERATIVE FOR SATISFACTORY OPERATION OF NOT ONLY THE ASA, BUT THE BRAKE ITSELF, THAT AFTER INSTALLATION THE SLACK ADJUSTER WILL OPERATE FROM FULL RELEASE POSITION (CHAMBER PUSH ROD FULLY RETRACTED) TO FULL AIR CHAMBER STROKE POSITION (CHAMBER PUSH ROD FULLY EXTENDED) WITHOUT ANY INTERFERENCE WITH ADJACENT CHASSIS COMPONENTS SUCH AS AXLE OR SUSPENSION MEMBERS. SHOULD INTERFERENCE BE ENCOUNTERED, CORRECTIVE MEASURES TO ELIMINATE THE INTERFERENCE, APPROPRIATE TO THE SPECIFIC CIRCUMSTANCES, MUST BE TAKEN BEFORE THE INSTALLATION CAN BE CONSIDERED COMPLETE. UNDER NO CIRCUMSTANCES SHALL THE SLACK ADJUSTER BE MODIFIED IN ANY WAY WHATSOEVER.

1.2 IF IT IS NECESSARY TO WELD IN THE AREA OF THE AUTOMATIC SLACK ADJUSTER, TAKE ADEQUATE PRECAUTIONS TO PROTECT THE RUBBER BOOT AGAINST WELD SPATTER.

1.3 THE MANUAL ADJUSTING NUT TURNS WITH MINIMAL RESISTANCE IN ONE DIRECTION ONLY. DO NOT FORCE IT AGAINST RESISTANCE ANYTIME DURING INSTALLATION OR ADJUSTMENT.

FIGURE A



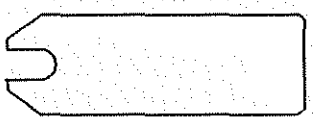
2. INSTALLATION PROCEDURES:

2.1 ASSEMBLE BRAKE CHAMBER TO BRAKE ASSEMBLY BRACKET.

2.1.1 DO NOT INSTALL ANY WASHERS BETWEEN CHAMBER AND BRACKET.

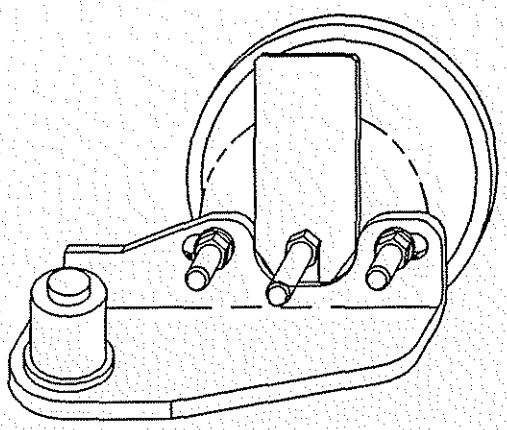
2.2 POSITION AND MAINTAIN THE ASA GAUGE (SHOWN IN FIGURE B) AGAINST THE FACE OF THE CHAMBER AND AROUND THE PUSH ROD. THREAD THE CLEVIS JAM NUT ON THE PUSH ROD UNTIL IT MAKES CONTACT WITH THE GAUGE (SEE FIGURE C). THREAD THE CLEVIS ON THE PUSH ROD AND FINGER TIGHTEN AGAINST THE JAM NUT.

FIGURE B



THICKNESS: .480" ± .065

FIGURE C



2.2.1 THE CLEVIS IS TO BE THREADED ON THE PUSH ROD WITHIN +1/8"/-1/4" OF FULL THREAD ENGAGEMENT AND ALIGNED TO ACCEPT THE SLACK ADJUSTER ARM

PROCEED TO STEP 2.4.4 IF THE BRAKE ASSEMBLY IS RECEIVED WITH THE ASA FACTORY INSTALLED.

2.3 REMOVE SNAP RING, WASHERS, AND SPACER FROM CAMSHAFT.

2.4 INSTALL THE AUTOMATIC SLACK ADJUSTER ONTO THE CAMSHAFT SPLINE POSITIONING THE SLACK ADJUSTER SO THAT THE ADJUSTER ACTUATOR ROD IS ON THE SIDE AWAY FROM THE CHAMBER WITH THE SLACK ADJUSTER ARM JUST CLEARING THE CLEVIS.

2.4.1 ALWAYS INSTALL THE SLACK ADJUSTER SO THAT THE ADJUSTING PAWL CAPSCREW IS ACCESSIBLE, PERPENDICULAR TO THE AXLE OR FACING TOWARDS THE VEHICLE CENTERLINE.

2.4.2 INSTALL SPACING WASHERS, AS REQUIRED, ON THE CAMSHAFT TO POSITION THE SLACK ADJUSTER ON THE CAMSHAFT IN LINE WITH THE AIR CHAMBER PUSH ROD, WITH MAXIMUM END PLAY OF 1.6MM (.062") ALONG THE CAMSHAFT

2.4.3 SECURE THE SLACK ADJUSTER TO THE CAMSHAFT BY INSTALLING SNAP RING.

2.4.4 ROTATE THE ASA ON THE CAMSHAFT BY TURNING THE MANUAL ADJUSTING NUT ON THE BOTTOM OF THE ASA UNTIL THE ADJUSTER ARM ROTATES INTO THE CLEVIS WITH THE LARGE HOLES IN THE ADJUSTER ARM AND THE CLEVIS ALIGNED.

2.4.4.1 THE NUT WILL ROTATE FREELY IN ONLY ONE DIRECTION. DAMAGE WILL OCCUR TO THE PAWL IF NUT IS ROTATED AGAINST RESISTANCE.

2.4.5 INSERT THE LARGE CLEVIS PIN THROUGH THE CLEVIS AND ADJUSTER ARM WITH THE PINHEAD ON THE INBOARD (VEHICLE) SIDE OF THE ASA. INSERT THE LARGE CLEVIS PIN RETAINER CLIP.

2.4.6 USING TWO FINGERS, ALIGN THE HOLE IN THE ASA ACTUATOR ROD WITH THE HOLE IN THE CLEVIS. INSERT THE SMALL CLEVIS PIN THROUGH THE CLEVIS AND THE ACTUATOR ROD WITH THE PINHEAD ON THE INBOARD (VEHICLE) SIDE OF THE ASA. INSERT THE SMALL PIN RETAINER CLIP.

2.5 TIGHTEN THE JAM NUT AGAINST THE CLEVIS TO HOLD THE CLEVIS IN THE CORRECT POSITION.

2.5.1 TIGHTEN THE JAM NUT TO A TORQUE OF 20-30 LB-FT FOR 1/2"X20 THREADS (REF. 12" AND 16" CHAMBERS) AND TO A TORQUE OF 25-50 LB-FT FOR 5/8"X18 THREADS (REF. 20" AND LARGER CHAMBERS).

2.6 ADJUST BRAKES.

2.6.1 TURN THE MANUAL ADJUSTING NUT IN THE DIRECTION OF LEAST RESISTANCE UNTIL THE BRAKE ASSEMBLY FREE STROKE IS 13-16MM (.500-.625 INCH). FREE STROKE IS NOT TO EXCEED 16MM (.625 INCH). REFER TO FIGURE #D.

2.6.1.1 .00 INCH FREEPLAY IS ALLOWED AT AXLE BUILDUP WITH NEW COMPONENTS AS LONG AS THE BRAKE DRUM TURNS FREELY. SUBSEQUENT ADJUSTMENT MUST MAINTAIN .500 INCH MINIMUM FREEPLAY.

2.6.1.2 IF THE LINING CONTACTS THE DRUM.

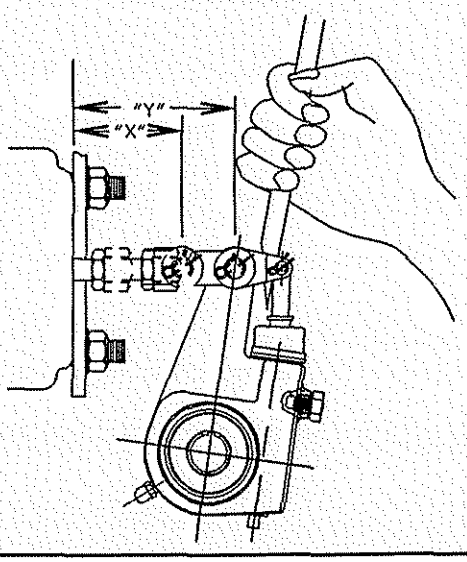
2.6.1.2.1 REMOVE THE PAWL ASSEMBLY FROM THE AUTOMATIC SLACK ADJUSTER.

2.6.1.2.2 TURN THE ADJUSTING NUT 1/2 TURN IN THE OPPOSITE DIRECTION.

2.6.1.2.3 REINSTALL THE PAWL ASSEMBLY.

2.6.1.2.4 TORQUE THE CAPSCREW TO 15-20 FT-LBS.

FIGURE D



"Y" MINUS "X" = FREE STROKE

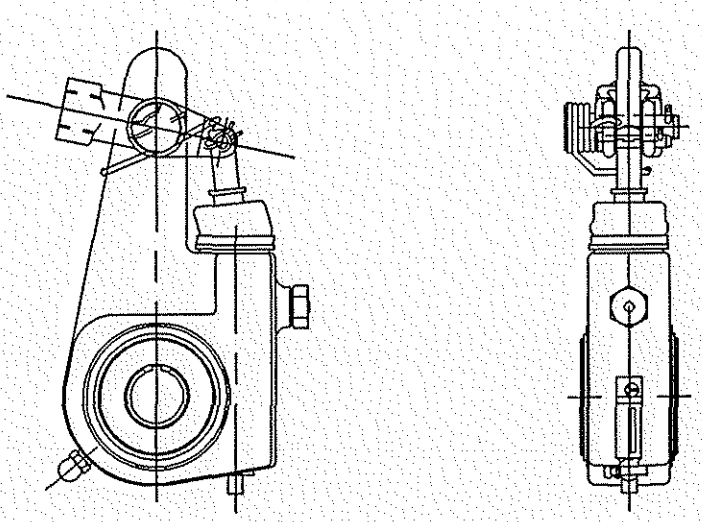
MAXIMUM FREE STROKE 16MM (.625 INCH).

3. HELPER SPRINGS

3.1 HELPER SPRINGS ARE REQUIRED FOR ASA APPLICATIONS WITH CHAMBERS SMALLER THAN T16.

3.2 THE HELPER SPRINGS ARE USED IN PAIRS, BLACK FINISHED FOR THE LEFT SIDE, AND BLUE FINISHED FOR THE RIGHT SIDE, AND INSTALLED WITH A LONG SHOULDERED CLEVIS PIN (REFER TO FIGURE E).

FIGURE E



LEFT HAND SIDE SHOWN

3.2.1 INSERT THE CLEVIS PIN INTO THE COIL OF THE SPRING WITH THE LONG SPRING ARM TOWARDS THE CLEVIS PIN HEAD. INSERT THE CLEVIS PIN THROUGH THE CLEVIS AND THE ADJUSTER ARM WITH THE PINHEAD ON THE INBOARD (VEHICLE) SIDE OF THE ASA. INSERT THE CLEVIS PIN RETAINER.

3.2.2 REPEAT STEP 2.6.6 TO INSTALL SMALL CLEVIS PIN.

3.2.3 CONNECT THE SPRING WITH ITS SHORT ARM OVER THE TOP OF THE CLEVIS AND ITS LONG ARM AROUND THE ADJUSTER ARM BENEATH THE THREADED END OF THE CLEVIS (REFER TO FIGURE E).

COMPILED	DDT	SHOP PRACTICE LUBRICATION, GREASE FRONT WHEEL BEARINGS	SECTION NUMBER 33-10116
APPRV	JSB		
ISSUE DATE	02/04/93		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0010-012 FOR FRONT WHEEL BEARING,LUBE AND GREASE.

COMPILED	DDT
APPRV	JSB
ISSUE DATE	02/04/93
REV DATE	03/28/95
CHG LTR	A

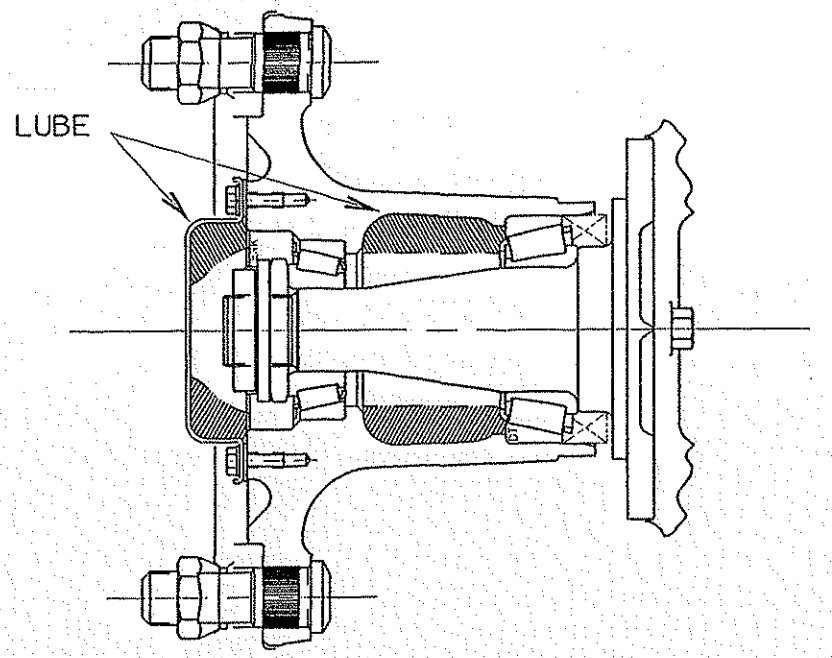
SHOP PRACTICE

LUBRICATION, GREASE FRONT WHEEL BEARINGS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-10116

PA2042-52



A. STANDARD GREASE

1. WITH A WHEEL BEARING PACKER, FORCE THE SPECIFIED LUBRICANT INTO THE WHEEL BEARING CAVITIES BETWEEN THE ROLLERS AND CAGE FROM THE LARGE SIDE.
2. PACK THE HUB, BETWEEN THE BEARING CUPS, WITH LUBRICANT TO THE LEVEL OF THE SMALLEST DIAMETER OF THE CUPS.
3. INSTALL THE OUTER BEARING CONES INTO THE CUP IN THE HUBS/SPOKE WHEEL.
4. INSURE WHEEL SEALS ARE PROPERLY INSTALLED.
5. INSTALL THE HUB AND DRUM ASSEMBLY. INSTALL THE OUTER WHEEL BEARING CONE IN THE HUB. INSTALL THE ADJUSTING NUT.
6. ADJUST WHEEL BEARINGS IN ACCORDANCE WITH 33-10101.
7. FILL HUB CAP WITH SPECIFIED LUBRICANT.
8. INSTALL GASKET AND HUB CAP.

B. SEMI-FLUID GREASE (MOBIL MULTILITH SHC 007 OR EQUIVALENT)

1. INSTALL INNER BEARING AND WHEEL SEAL. DO NOT PACK BEARING WITH GREASE.
2. INSTALL HUB/DRUM ASSEMBLY ON AXLE. LEAVE CRANE OR LIFT MECHANISM IN PLACE SUPORTING THE ASSEMBLY.
3. PUMP GREASE INTO INNER BEARING UNTIL FILLED.
4. PUMP GREASE INTO HUB CAVITY UNTIL FILLED TO TOP OF OUTER BEARING CUP.
5. INSTALL OUTER BEARING CUP.
6. PUMP GREASE INTO OUTER BEARING CONE UNITL FILLED.
7. INSTALL AND ADJUST SPINDLE NUTS.
8. PARTIALLY FILL HUB CAP (APPROXIMATELY 1/3 FULL) WITHOUT COVERING THE CENTER VENT/FILTER ELEMENT.
9. INSTALL GASKET AND HUB CAP ONTO HUB.

COMPILED	F.FREER
APPRV	DRS
ISSUE DATE	04/30/73
REV DATE	10/11/94
CHG LTR	AC

SHOP PRACTICE

CONTENTS
REAR AXLE

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-11100

PA2101-06

	33-11101	WHEEL BEARING ADJUSTMENT
	33-11102	HUB STUD AND BEARING CUP INSTALLATION
	33-11103	WELDING BRACKETS TO AXLE HOUSINGS
	33-11104	AXLE PLANING
	33-11105	AXLE INSTALLATION
	33-11106	AXLE LUBRICATION
	33-11107	AXLE SHIFT INSTALLATIONS
	33-11109	TORQUING OF SCREW FASTENERS
	33-11110	WEDGE BRAKE INSTALLATION
	33-11111	AXLE ALIGNMENT PROCEDURE
	33-11113	BRAKE TUBE SUPPORT BRACKET LOCATION
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	33-11115	OIL LEVEL HOLE LOCATION
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	33-11123	AUTOMATIC SLACK ADJUSTER INSTALLATION, HALDEX
	33-11124	DUST SHIELD INSTALLATION, EATON BRAKE
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COMPILED	B.EVENS	SHOP PRACTICE WHEEL BEARING ADJUSTMENT REAR AXLE	SECTION NUMBER 33-11101
APPRV	HADDOCK		
ISSUE DATE	04/07/65		PAGE 1 OF 1
REV DATE	09/25/95	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	M		PA2042-59

REFER TO MANUFACTURING ENGINEERING'S SHOP PRACTICE K09-11001-S00 FOR REAR AXLE WHEEL BEARING ADJUSTMENT PROCEDURE.

COMPILED	B E
APPRV	K H
ISSUE DATE	04/07/65
REV DATE	07/29/96
CHG LTR	N

SHOP PRACTICE

WHEEL BEARING ADJUSTMENT REAR AXLE

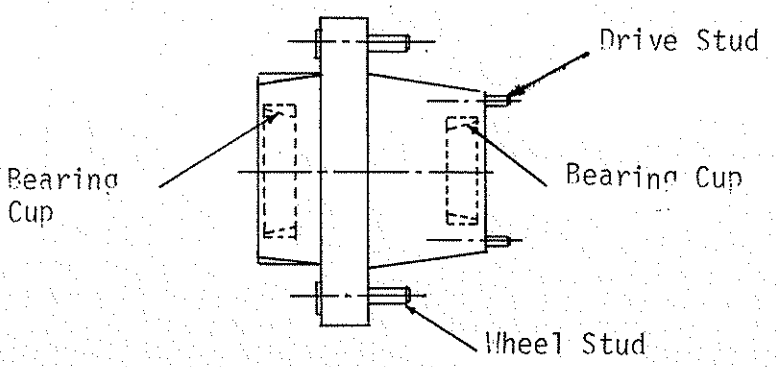
FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-11101

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-001 FOR REAR AXLE WHEEL BEARING ADJUSTMENT PROCEDURE.

Compiled	K. HADDOCK	SHOP PRACTICE HUB STUD & BEARING CUP INSTALLATION	33-11102
Approved	KRH		
Issued	7/21/71		
Revised	4-4-80	Chg Ltr E FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-20



1. Drive Stud Installation

   Install drive studs with the hubs at room temperature. Precoat the studs with locking compound (ref. 48-02110) before installation. Torque to 45-60 ft. lbs.

2. Wheel Stud Replacement
   Refer to 33-10102 for proper procedures.

3. Bearing Cup Replacement

   Refer to 33-10102 for proper procedures.

COMPILED	K H	SHOP PRACTICE HUB STUD AND BEARING CUP INSTALLATION	SECTION NUMBER 33-11102
APPRV	KRH		
ISSUE DATE	07/21/71		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	F		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-002 FOR AXLE HUB STUD AND BEARING CUP INSTALLATION.

This section outlines the quality standards and acceptance criteria necessary to consistently produce sound welds on fabricated axle housings welded in-house and should be used in conjunction with associated Engineering, Manufacturing and Quality Control standards and specifications. Vendor welding practices may differ.

1. General

Extremely good judgment must be used by the Quality Assurance Inspector when applying the weld acceptance criteria. Service usage and appearance must be considered when inspecting welds. Extreme conditions must be avoided and corrections made prior to vehicle release.

Each weld surface should be visually examined by the inspector to determine the quality of the joint. Welds should exhibit characteristics of fusion, penetration and soundness of weld deposit indicative of good welding practice and reliable service life.

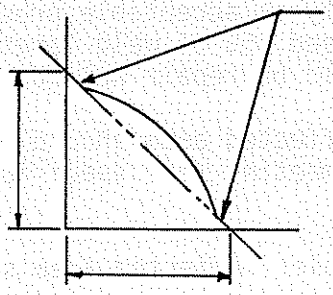
The weld should be of good appearance and not have excessive weld metal. Axle housings are to be warmed to room temperature prior to welding.

2. Weld Shape

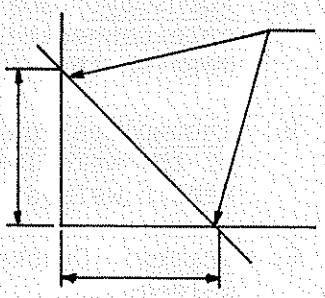
All fillet welds must blend smoothly with the axle housing and attachment along the full length of the weld including the ends.

ACCEPTABLE FILLET WELD PROFILES

PREFERRED



OPTIONAL

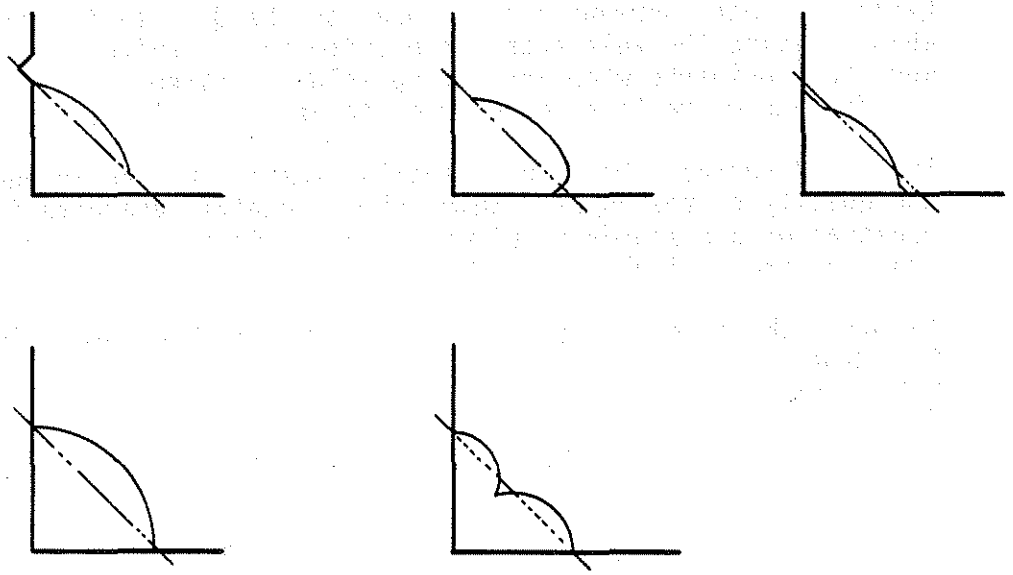


SMOOTH BLEND

REVISED AND RETYPED " " CHANGE

2. Weld Shape (cont.)

Unacceptable Fillet Weld Profiles



3. Welding Irregularities

The acceptability criteria of the weld with respect to various welding irregularities (or defects) are listed below. Housing not meeting these requirements are to be rejected.

A. Porosity: Small pinhole porosity is acceptable providing it is not interconnected and does not exceed 15% of weld length. Areas not meeting this specification should be repair welded.

B. Incomplete Fusion (Overlap): Affected area should not exceed 10% of the weld length. Areas not meeting this specification should be repair welded.

C. Cracks: Cracks are not acceptable. Affected area should be repair welded.

3. Welding Irregularities (cont.)

   D. Undercutting: Undercutting on the base housing is acceptable providing it does not exceed 1 mm in depth and 25% of weld length. Undercutting or heat erosion on the bracket is acceptable if it does not give an excessive rutter appearance. Areas not meeting these specifications should be repair welded.

   E. Craters: All craters of excessive length or depth should be repair welded.

   F. Voids: Voids are not acceptable and should be repair welded.

4. Welding Prohibitions:

   A. Intersecting Welds: The combination of welds may not form three or more intersecting deposits; i.e., branch (Y) or cross (X) patterns. If fabricated (welded) brackets are being used, the combination of welds on the bracket and the attachment may not form the above pattern.

   B. Corners of square or rectangular brackets are not to be welded, ref. page

   C. Bottom Surfaces of axle housing are not to be welded.

   D. Circumferential welds ringing the housing.

   E. Vertical/Fore & Aft straight welds.

   F. Test Arcs on the housing.

5. Welding Electrodes: Make all welds with low hydrogen electrodes (ref. AWS specifications E-7016, E-7018) using the voltage and amperage recommended by the manufacturer.

   Option for Wire Feed Welders: Use E-70 solid wire with gas shielding suitable for low hydrogen practice.

6. Axle Manufacturer Requirements

A. Rockwell: Deposit the required amount of metal with the least number of passes.

B. Eaton: All fillet welds must be made in two passes. A third pass for clean-up is permitted, if necessary.

7. Housing Bowl Mounted Brackets

Brackets attached to the housing bowl should be welded all around as illustrated in Figure 1. Fillets the thickness of the housing wall will be used. The attachments should fit-up as close as possible to avoid excessive welding.

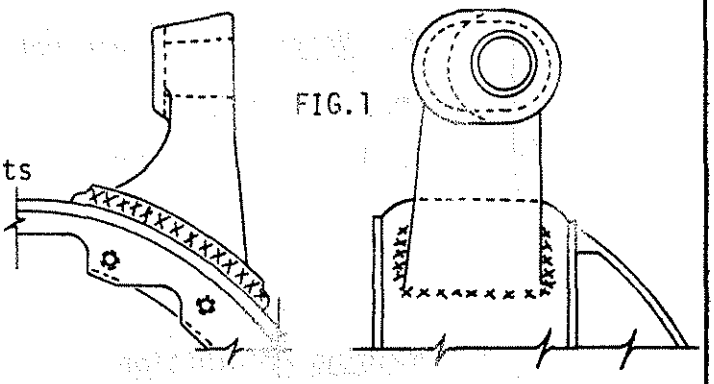


FIG.1

On brackets that require welding all around, distortion and stress can be controlled by welding on opposite sides of the bracket alternately. Figure 2 shows the tack welding sequence while Figure 3 shows the sequence and direction of final welding. Cover the tack welds with the final welds.

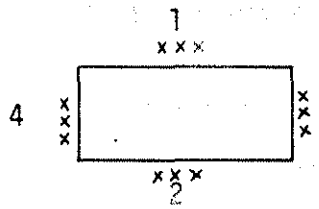


FIG. 2

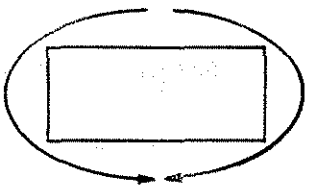


FIG. 3

On brackets that are only welded on two sides, tack weld the bracket in the center on each side as shown in Figure 4. Then final weld from the edge of the bracket towards the tack welds using the sequence in Figure 5. Cover the tack welds with the final welds. Back up over the weld bead for a short distance (1" approximate) at the end of the stroke.

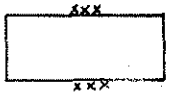


FIG. 4

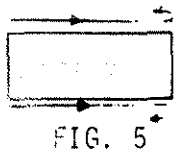


FIG. 5

8. Housing Arm Mounted Brackets

Limit welding on drive axle housings to areas of minimum stress, see Figures 6 and 7. Make welds short and horizontal, at or near the front and rear horizontal centerline of the housing arm, and to short sidewise (longitudinal to the axle) welds and plug or circular fillets on the top surface.

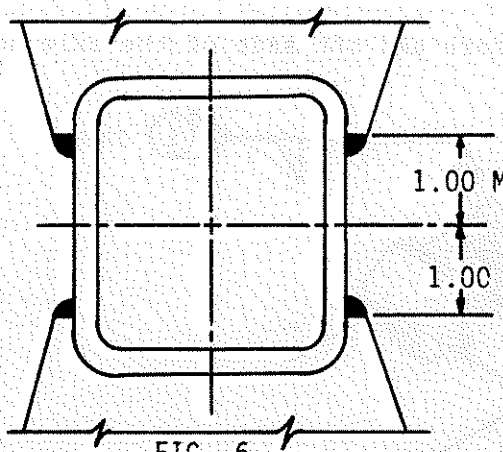


FIG. 6
FREIGHTLINER SPRING SUSPENSION

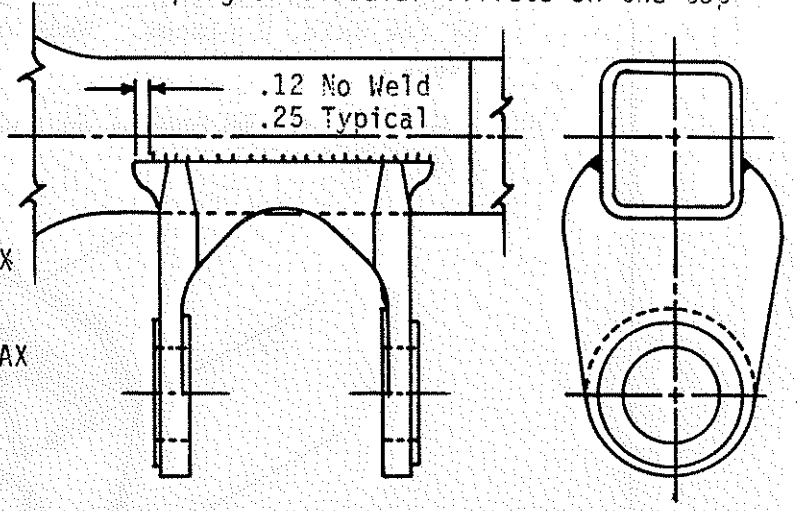
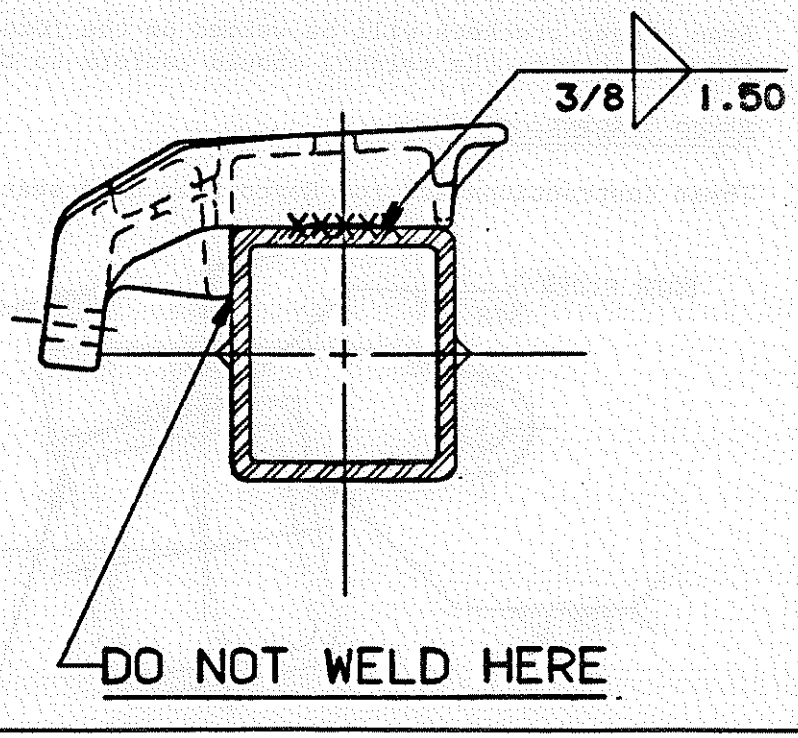


FIG. 7

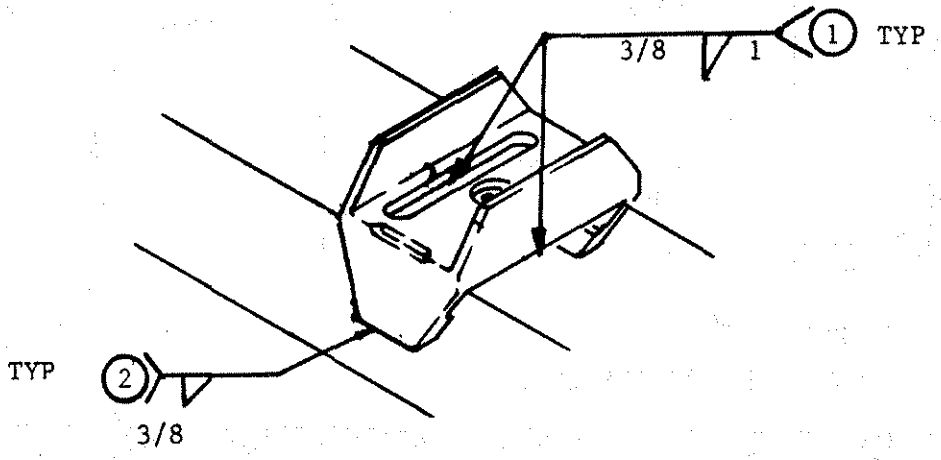
FREIGHTLINER SPRING SUSPENSION



FREIGHTLINER AIR SUSPENSION

1. Tack weld in slots and/or at the casting's edge, near the centerline of the axle, 2 places. Weld over the tack welds with a 1.00 long x 3/8 bead.

2. A minimum of two passes on the fore and aft side of the axle housing is required.

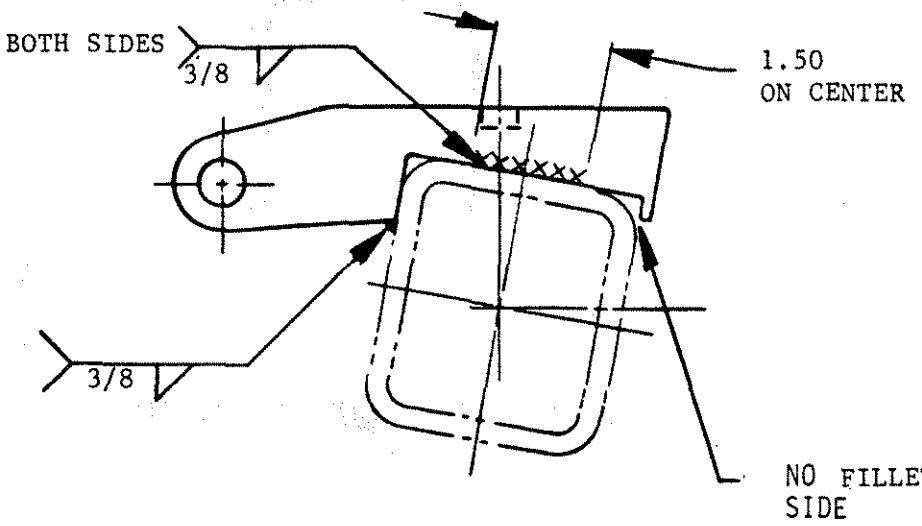


HENDRICKSON SUSPENSIONS

Beam hanger brackets will be welded on the fore and aft sides only, In all other respects, the welding should conform to the above specifications.

REYCO SUSPENSION

These instructions are for Reyco rear axle seats.



COMPILED	EVENS
APPRV	KRH
ISSUE DATE	11/18/86
REV DATE	07/29/96
CHG LTR	D

SHOP PRACTICE

WELDING BRACKETS TO AXLE HOUSING

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-11103

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-003 FOR WELDING BRACKETS TO AXLE HOUSING.

Compiled	L. UHL	SHOP PRACTICE "PLANING" AXLES	33-11104
Approved	DCR		
Issued	9-4-87		
Revised	2-5-88	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

Principles

The driveline we use (or any truck builder uses) is not a constant velocity joint. That is, when the two parts of a joint are at an angle to each other, if one part is rotating at a constant speed, the other part must speed up and slow down twice for each revolution of the shaft. To compensate for this, we use joints in pairs with the input and output shafts parallel.

The ideal situation is one in which the axle pinion shafts are parallel with the transmission shaft and engine crankshaft. When the two input shafts of a tandem drive unit are the same height, such as in the SQHP, the axles are shimmed so that the pinions are parallel with each other as well as the transmission(s) and engine. This will eliminate any vibration due to varying shaft speeds, since only the driveline speeds vary.

However, the majority of the tandem units we use have a high pinion on the front axle and a low pinion on the rear. This arrangement seriously limits the amount of axle articulation which can be tolerated because with the truck on level ground, the interaxle driveline already makes an angle of 10° or 12° with the pinion shafts. Then, if the front axle encounters a hump, it goes up while the rear goes down, relatively, and soon the driveline angle reaches its limit.

On this type of axle, we can improve the articulation ability by raising the front of the rear axle to cut down on the initial driveline angle. This puts the rear axle out of parallel and produces a minor vibration, but half of this is taken care of by the interaxle differential. It is a compromise we must make.

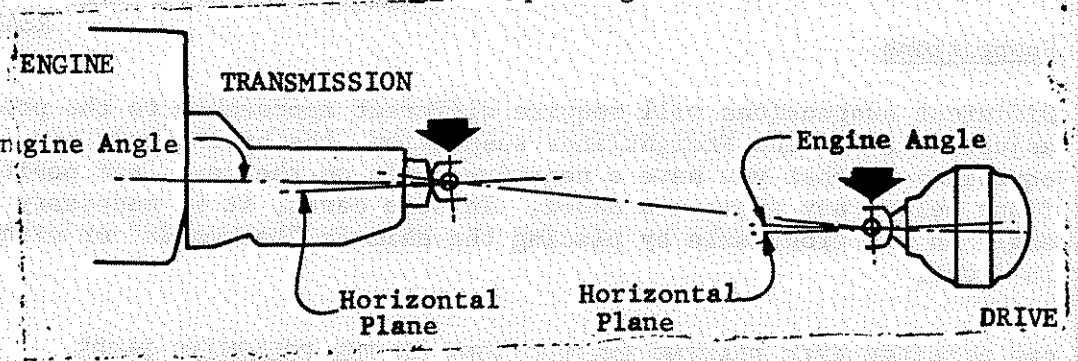
Measurement

Always measure axle plane with a level on a machined surface which is known to be parallel with the pinion shaft. This may be a driveline yoke or flange.

Remember that the angle you read is measured from the horizontal. Measure the engine angle and subtract the two to find the relative angle. Using the frame as a basis in not recommended.

SINGLE DRIVE AXLE

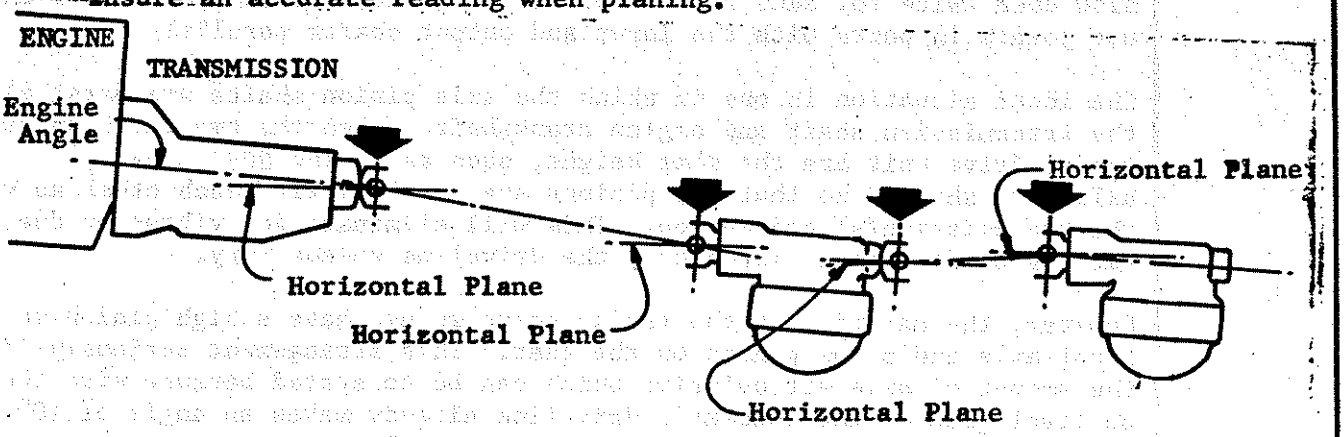
The arrows indicate the points at which the protractor should be placed to insure an accurate reading when planing.



Measurement (Continued)

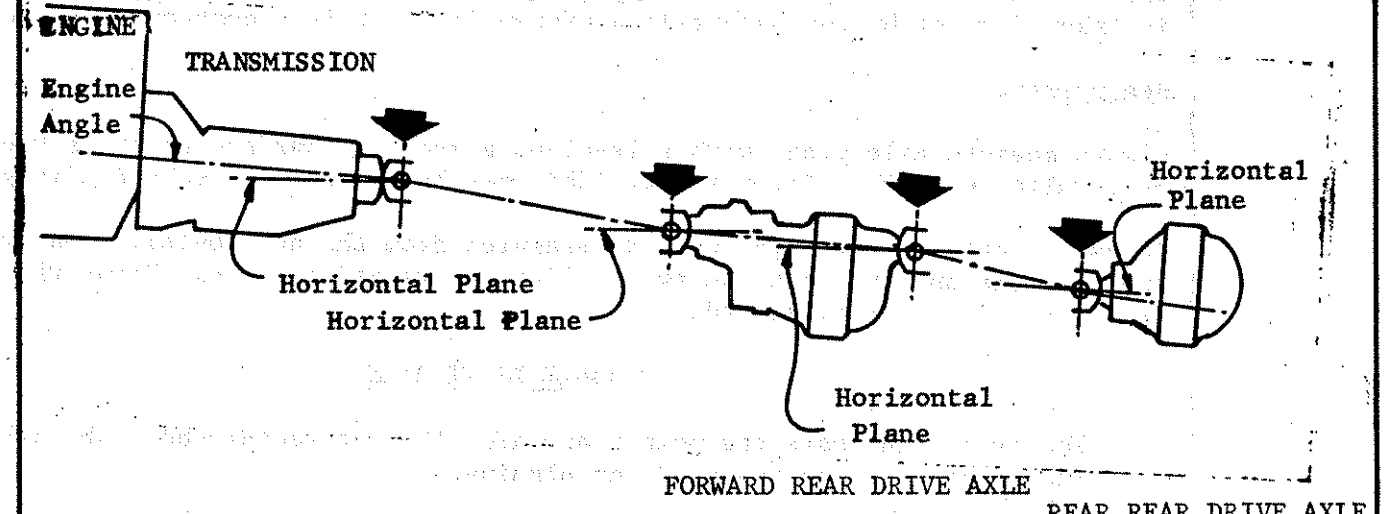
TANDEM DRIVE AXLE, DRIVE PINIONS EQUAL HEIGHT

The arrows indicate the points at which the protractor should be placed to insure an accurate reading when planing.



TANDEM DRIVE AXLE, DRIVE PINIONS UNEQUAL HEIGHT

The arrows indicate the points at which the protractor should be placed to insure an accurate reading when planing.



Suspensions

Different suspensions will require different approaches to the problem of adjustment. On the Freightliner suspension, the spring ends are low at the equalizer so that you have a negative angle on the rear, and positive on the front before any shims are added. In some cases, it is necessary to reduce the angle on the front axle by placing the shim in "backwards" or with the thick part in front.

SEE DETAILED AXLE PLANING INSTRUCTIONS ON THE FOLLOWING PAGES

Compiled	L.UHL	Shop Practice	33-11104
Approved	D.C.R.	Axle Planing FREIGHTLINER SPRING SUSPENSIONS	
Issued	09/04/87		
Revised	2-5-88	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 3

TOLERANCES: ANGLE = ± ½°

FREIGHTLINER SPRING SUSPENSIONS: SIDE = ± ½° Relative to DL Yoke

AXLE MODEL	SUSPENSION MODEL	AXLE SPACING	ENGINE ANGLE	PLANING ANGLE	
				FORWARD	REAR
ALL SINGLE DRIVES	ALL SPRING	-	-	@ ENGINE	ANGLE
ROCKWELL SSHD SQ-100, SQ-100P	ALL SPRING	ALL	3°00'	3°00'	5°00'
EATON 402 402P 401P 451P SERIES	ALL SPRING	ALL	3°00'	3°00'	5°00'
461P	ALL SPRING	52.00 54.00	3°00'	3°00'	5°00'
		60.00	3°00'	3°00'	5°00'

Compiled	L. UHL	Shop Practice	33-11104
Approved	D.C.R.	Axle Planing FREIGHTLINER AIR SUSPENSION	
Issued	9-4-87		
Revised	2-5-88	Chg Ltr B **FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 4

FREIGHTLINER AIR SUSPENSIONS:

CONDITION: UNLOADED

AXLE MODEL	ENG. ANGLE	AXLE			
		FORWARD		REAR	
		ANGLE (1)	SHIM (2)	ANGLE (1)	SHIM (2)
ALL SINGLE DRIVES	3°	2°	1° (3)	-	-
	4°	3°	None	-	-
	5°	4°	1° (4)	-	-
	5½°	4½°	1½°	-	-
ROCKWELL: SQ-100 SQ-100P, SSHD	3°	2°	1° (3)	4°	1° (4)
EATON: All	4°	3°	None	5°	2° (4)

(1.) Ref. unloaded condition angle will increase 1° at rated load.

(2.) Reference only.

(3.) Thick edge of shim forward

(4.) Thick edge of shim back.

Compiled	L. UHL	Shop Practice	
Approved	D.C.R.	Axle Planing NEWAY SUSPENSIONS	33-11104
Issued	9-4-87		
Revised	2-5-88	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 5

NEWAY SUSPENSIONS:

TOLERANCES: ANGLE = ± ½°

AXLE MODEL	SUSPENSION MODEL	AXLE SPACING	ENGINE ANGLE	PLANING ANGLE	
				FORWARD	REAR
ALL SINGLE DRIVES	ALL SINGLE	-	-	@ ENGINE ANGLE	
ROCKWELL SQ-100, SQ-100P	ALL TANDEM	ALL	3°00'	3°00'	5°00'
ROCKWELL SSHD	ALL TANDEM	ALL	3°00'	3°00'	5°00'
EATON 402(P) 401(P) 451(P) SERIES	ALL TANDEM	ALL	3°00'	3°00'	5°00'
EATON 461(P) SERIES	ALL TANDEM	52.00 54.00	3°00'	3°00'	11°30'
		60.00	3°00'	3°00'	5°00'
ROCKWELL RT-48-180	ALL TANDEM	65" 70"	3°00'	3°00'	3°00'

HENDRICKSON SUSPENSION: TOLERANCE: ANGLE = ± ½°

AXLE MODEL	SUSPENSION MODEL	AXLE SPACING	ENGINE AXLE	PLANING ANGLE	
				FORWARD	REAR
ROCKWELL SQ-100 SQ-100P	RS, RT, RTE SERIES	52	3°00'	3°30'	9°30'
		54-72	3°00'	3°30'	3°30'
ROCKWELL SSHD	RS, RT, RTE SERIES	52	3°00'	3°30'	9°00'
		54-72	3°00'	3°30'	3°30'
ROCKWELL RT-48-180	RS, RT, RTE SERIES	52	NOT	AVAILABLE	
		54	3°00'	3°30'	11°00'
	RS, RT, RTE (EXCPT RTE-380)	60	3°00'	3°30'	3°30'
	RTE-380	60	3°00'	3°30'	9°30'
	RS, RT, RTE SERIES	72	3°00'	3°30'	3°30'
EATON 401P, 402, 451P	RS, RT, RTE SERIES	ALL	3°00'	3°30'	3°30'
EATON 461P	RS, RT, RTE	52	3°00'	3°30'	10°30'
	RS, RT, RTE SERIES	54	3°00'	3°30'	10°00'
		60-72	3°00'	3°30'	3°30'

REYCO SUSPENSIONS

The axle seats supplied with the suspension are machined to proper angle. Shimming is not required. Values below for reference only.

AXLE MODEL	SUSPENSION MODEL	AXLE SPACING	ENGINE ANGLE	PLANING ANGLE	
				FORWARD	REAR
ROCKWELL SQ-100 SQ-100P	ALL REYCO	50.00 52.00	3°00'	3°00'	11°.00'
SSHD		50.00 52.00	3°00'	3°00'	10°00'
EATON 402, 402P, 401P,451P Series		50.00 52.00	3°00'	3°00'	10°00'
461P		50.00 52.00	3°00'	3°00'	11°00'
402	REYCO AIR RIDE	52.0	3°	3°	10° FF
SQ-100	REY AIR RIDE	52.0	3°	3°	11° FF

CHALMERS SUSPENSION

TOLERANCES: ANGLE = ± ½°

AXLE MODEL	SUSPENSION MODEL	ANGLE SPACING	ENGINE ANGLE	PLANING ANGLE	
				FORWARD	REAR
ROCKWELL SQ-100 SQ-100P	ALL CHALMERS	52 54 60 72	3°00' 3°00' 3°00' 3°00'	3°00' 3°00' 3°00' 3°00'	10°00' 10°00' 3°00' 3°00'
ROCKWELL SSHD		52 54 60 72	3°00' 3°00' 3°00' 3°00'	3°00' 3°00' 3°00' 3°00'	10°00' 9°00' 8°00' 6°00'
EATON 402 402P 401P 451P		52 54 60 72	3°00' 3°00' 3°00' 3°00'	3°00' 3°00' 3°00' 3°00'	3°00' 3°00' 8°00' 3°00'
EATON 461P		52 54 60 72	3°00' 3°00' 3°00' 3°00'	3°00' 3°00' 3°00' 3°00'	10°00' 10°00' 9°00' 7°00'

PAGE & PAGE SUSPENSIONS

CONTACT PRODUCT/CUSTOM

RIDEWELL SUSPENSIONS

CONTACT PRODUCT/CUSTOM ENGINEERING

ROCKWELL SUSPENSIONS

CONTACT PRODUCT/CUSTOM ENGINEERING

3. Tri-drive - Plane axles according to the following:

AXLE TYPE	SUSPENSION TYPE	ANGLE			
		ENGINE	1st AXLE	2nd AXLE	3rd AXLE
Timken ERQHD Std ERQHD Wide Track	Hendrickson R3-480 Hendrickson Tandem and Neway-Air	0^{o} 00' 1^{o} 26' 2^{o} 35' 3^{o} 00' 3^{o} 31' 4^{o} 23'	0^{o} 00' 1^{o} 26' 2^{o} 35' 3^{o} 00' 3^{o} 31' 4^{o} 23'	0^{o} 00' 1^{o} 26' 2^{o} 35' 3^{o} 00' 3^{o} 31' 4^{o} 23'	14^{o} 00' 12^{o} 30' 11^{o} 30' 11^{o} 30' 11^{o} 00' 10^{o} 00'

4. Trailer (or Non-Drive) Axles (Non-Steering):

A. Face axles as follows:

BRAKE TYPE	AXLE PLACEMENT
Wedge	Adjuster star for top brake shoe is to rear.
Cam	Determined by suspension inst.

B. Plane axles as follows:

AXLE		TOP OF AXLE IDENTIFICATION	INSTALLED ANGLE OF ROTATION	REF. ONLY	
MOD.	HOUSING SHAPE			TOE IN OR OUT	CAMBER
TK	Round	Punch Marks or Drilled Holes	0^{o}	0± 1/16	30'± 10'
RN	Rectangular or Square	Marked	(1)		

C. Interaxle Alignment: The distance from end center of one axle to the end center of the other axle should be within .12 at opposite ends of axle.

(1) Do not rotate from 0^{o} to effect a change in toe-in or out and camber.

5. Page & Page 750 series suspension.

A. The maximum shimming allowed is 4^{o}.

3. Tri-drive - Plane axles according to the following:

AXLE TYPE	SUSPENSION TYPE	ANGLE			
		ENGINE	1st AXLE	2nd AXLE	3rd AXLE
Timken ERQHD Std ERQHD Wide Track	Hendrickson R3-480 Hendrickson Tandem and Neway-Air	0° 00' 1° 26' 2° 35' 3° 00' 3° 31' 4° 23'	0° 00' 1° 26' 2° 35' 3° 00' 3° 31' 4° 23'	0° 00' 1° 26' 2° 35' 3° 00'	14° 00' 12° 30' 11° 30' 11° 30' 11° 00' 10° 00'

4. Trailer (or Non-Drive) Axles (Non-Steering):

A. Face axles as follows:

BRAKE TYPE	AXLE PLACEM
Wedge	Adjuster star brake shoe
Cam	Deter nst.

REMOVE & DESTROY 2-5-88

B. Plane axles as follows:

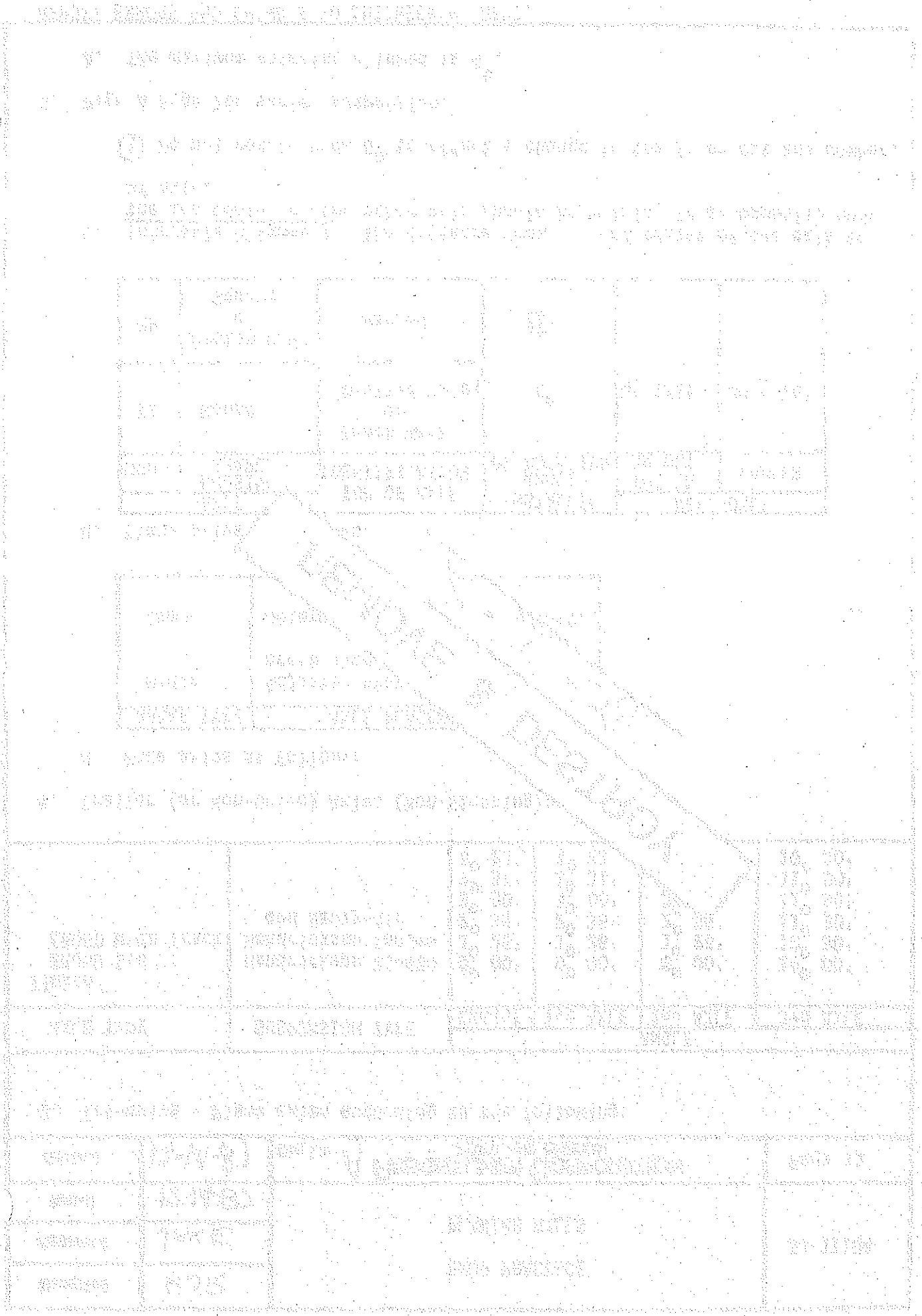
AXLE		TOP OF AXLE IDENTIFICATION	INSTALLED ANGLE OF ROTATION	REF. ONLY	
MOD.	HOUSING SHAPE			TOE IN OR OUT	CAMBER
TK	Round	Punch Marks or Drilled Holes	0°	0 ± 1/16	30' ± 10'
RN	Rectangular or Square	Marked	①		

C. Interaxle Alignment: The distance from end center of one axle to the end center of the other axle should be within .12 at opposite ends of axle.

① Do not rotate from 0° to effect a change in toe-in or out and camber.

5. Page & Page 750 series suspension.

A. The maximum shimming allowed is 4°.



Compiled	ANDERSEN	SHOP PRACTICE AXLE INSTALLATION	33-11105
Approved	D.C.R.		
Issued	3-2-86	FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1
Revised		Chng Ltr:	

GENERAL

Axles are usually installed on the vehicle as pre-assembled units including all parts from springs and fastening parts, radius rods and their axle brackets, and planing shims (see 33-11104), to the axle itself less wheels and tires. For ease of installation, minimum need for adjustment and modification after installation, and trouble-free operation in use, it is necessary to control certain potential trouble spots with great care. Fortunately, there are just a few such spots and they are readily taken care of.

B 1. Piping Timken "Failsafe" Brake Chambers - NOTE: DOES NOT COMPLY W/FMVSS #121.
In present installations of Timken "Stopmaster" brakes with "Failsafe" chambers, either the forward or the rear chamber is located higher than the axle housing. The chamber in the higher position must be installed rotated so that all fittings are lower than the highest part of the chamber (see Fig. 1), so that damage from frame interference may be avoided. To route the hoses up over the axle housing 45° elbows will be needed at the ports in the chamber.

The opposite chamber on the same brake will always be lower than the first chamber, so no special precautions need be taken with it.

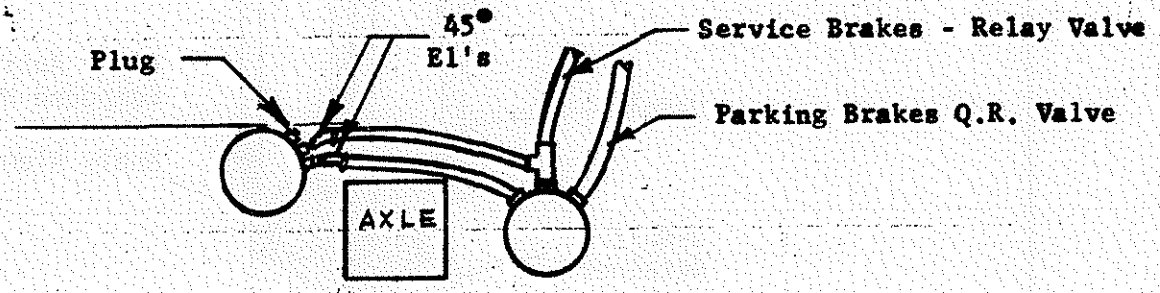


Figure 1.

2. U-Bolts
U-Bolts are used in Freightliner Suspensions to fasten, by clamping action, the axle, spring, and radius rod axle anchor bracket. Besides the main pieces in the stack, there are usually several other, such as U-Bolt Pad, Retainer Plate, Taper Shims, Spacers, Axle Pad, Flat Washers, Shock Absorber Clips, Axle Stops, etc., and the spring itself consists of several leaves. With all this mutiplicity of pieces, and considering the continual vibration to which the axle is subject, the importance of the proper installation of the U-Bolt and U-Bolt Nuts can hardly be overemphasized.

Without the U-Bolt the whole structure becomes merely a pile of loose parts. For this reason, certain properties affecting the performance of the U-Bolt must be carefully checked.

(Continued)

2. U-Bolts (continued)

A. Length

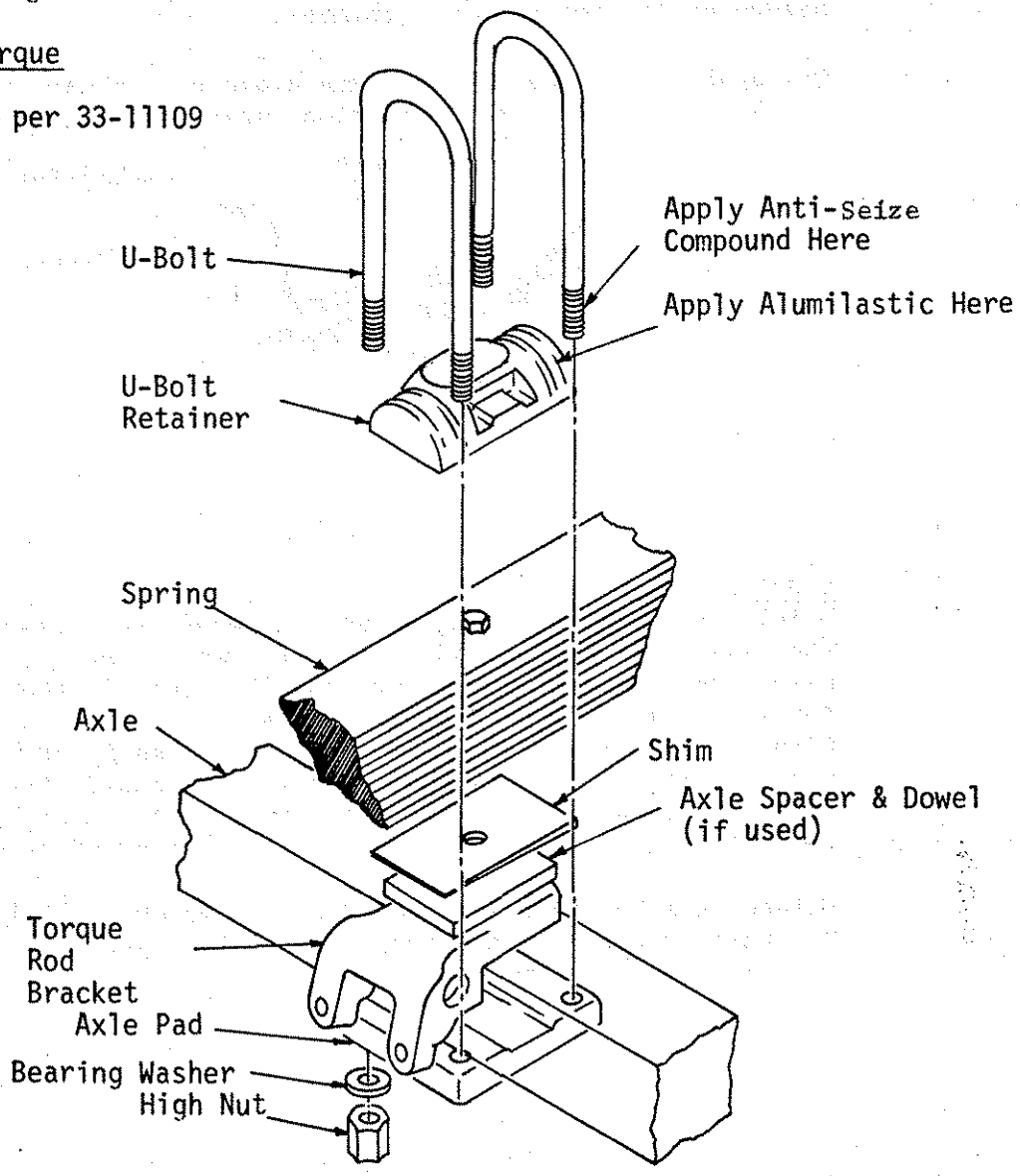
The U-bolt threads are to extend beyond the high nut by a minimum of three (3) threads and a maximum of 1.50" with the nuts fully tightened.

B. Lubricants

The threaded portion of the U-bolt is to be coated with anti-seize compound, 48-00094-101, or chassis lube, 48-00109-001, at time of assembly. The U-bolt pad is to have alumilastic, 48-00119, applied to the grooves.

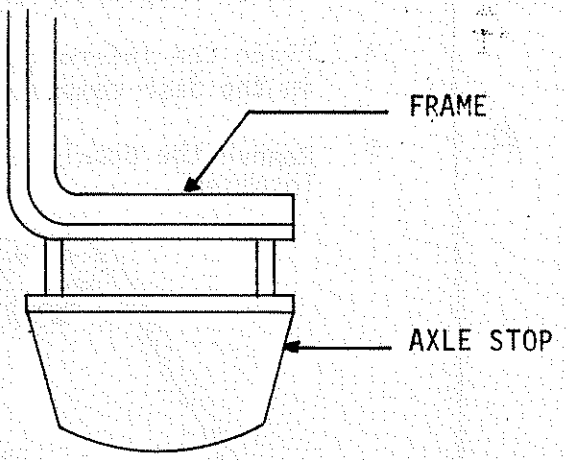
C. Torque

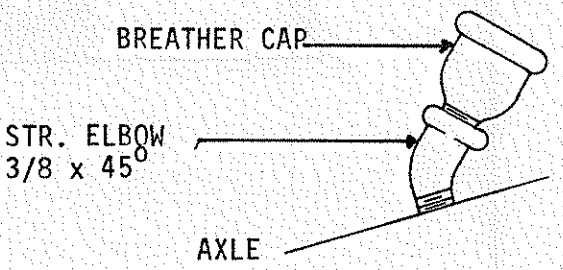
As per 33-11109



3. BREATHER CAP CLEARANCES

On all Axles, except Eaton, used with Freightliner & Henrickson Suspensions, install a 45° 3/8 elbow between the Axle Housing and Axle Breather Cap, turning the elbow to point the Breather Cap inboard.





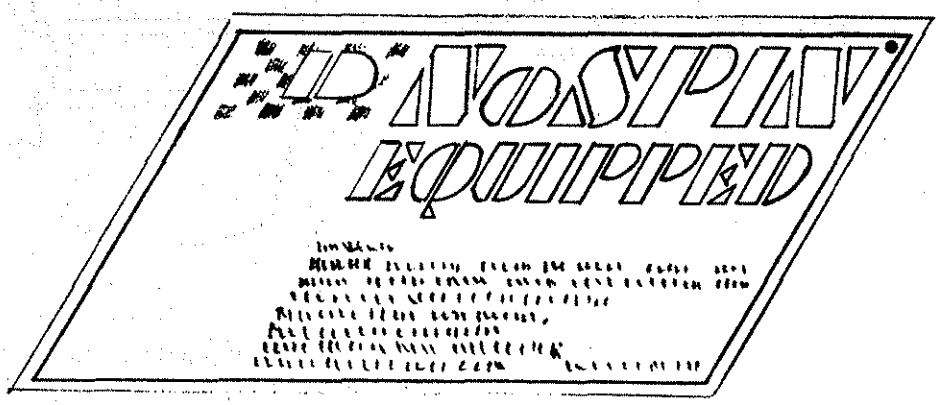
TRAC TECH

5. (DAP) No-Spin Differential

When this No-Spin Differential is mounted on a vehicle:

A. Place the information packet (which is included in the installation kit) in the dash compartment.

B. Remove the decal, and mount it on the left hand door in an unobstructed location.



COMPILED	ANDERSON	SHOP PRACTICE	SECTION NUMBER
APPRV	DCR	AXLE INSTALLATION	33-11105
ISSUE DATE	03/21/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	A		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-004 FOR AXLE INSTALLATION.

COMPILED	HJR	SHOP PRACTICE AXLE LUBRICATION	SECTION NUMBER 33-11106
APPRV	ANDERSON		
ISSUE DATE	04/03/72		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-005 FOR AXLE LUBRICATION.

3. DRIVE AXLE LUBRICATION SPECIFICATIONS

Lubricate Axle Drive Units, Shift Units and Hubs per VEHICLE LUBRICATION CHART (Form E-47, latest revision), Ref. 33-00102.

B 4. OIL FILTER AND COVER INSTALLATION PROCEDURES FOR SQHP AXLES

1. Filter:
   - A. Remove temporary filter base cover
   - B. Wipe the base with a clean cloth
   - C. Coat the new filter gasket face with axle oil.
   - D. Install the filter on the threaded stud and tighten one full turn after the gasket contacts the base. Do Not Overtighten.

2. Cover:
   - A. The cover is to be installed by using two threaded studs (ROK/4x1707), four washers (ROK/129E1669) and two locknuts (ROK/NL25-1). These should be shipped with the axle.
   - B. When the cover is assembled over the filter, the tabs on the cover will stand clear of the axle body.
   - C. Use 11/32" dia. flat washers (23-600-31) inserted over the studs so the tabs will contact the washers when the locknuts are tightened.
   - D. Torque the locknuts to 11 ft.lbs. Do Not Overtorque.

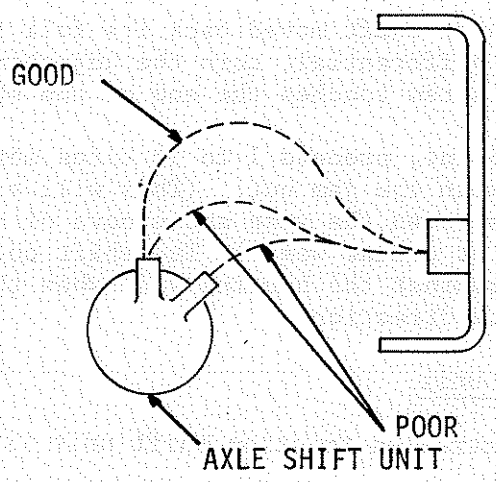
COMPILED	K H	SHOP PRACTICE	SECTION NUMBER 33-11107
APPRV	DCR	AXLE SHIFT INSTALLATION	
ISSUE DATE	04/07/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-006 FOR AXLE SHIFT INSTALLATION.

AIR

1. Securing Valve to Shift Lever - These valves frequently come loose from the shift lever in service. First put a drop or two of "Lock-Tite" Nut Lock CV (4-10) on the screw threads, then tighten them securely.

2. Air Lines - Air lines from frame to axle must be arranged to provide for vertical axle motion. See 12 - Group for general practice.



ELECTRIC

1. Shift Solenoid Mounting - Always mount the solenoid at least 1/2 inch above the bottom flange when locating it inside the frame. This will prevent an accumulation of dirt and water which may block the exhaust port.

Axle Shift Housing

1. Installation

   A. Position the gasket and shift housing assembly against the drive unit making sure that the shift lever yoke is properly located in the shift collar groove.

   B. Install the shift housing cap screws and tighten to the correct torque value.

2. Adjustment of Shift Shaft

   Adjust the positioning screw at the rear of the shift housing assembly in the following manner:

   A. With the shift shaft moved back its full travel locking the inter-axle differential, turn the adjusting screw in until the end of the screw touches the end of the shift shaft.

   B. From this point, proceed 1 to 1¼ turns more and lock the adjusting screw with the jam nut. (This will allow approximately .012" clearance between the yoke and groove of collar and thus eliminate yoke or collar wear.) The shift collar provides a definite stop against the housing wall when the shaft is shifted in the opposite direction.

A

3. Traction Shift Unit

   If a driver controlled traction shift unit is to be installed see 33-11116.

COMPILED	ERK	SHOP PRACTICE TORQUING OF SCREW FASTENERS	SECTION NUMBER 33-11109
APPRV	DCR		
ISSUE DATE	07/19/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	F		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-007 FOR TORQUING OF SCREW FASTENERS.

COMPILED	ERK
APPRV	D.REEVES
ISSUE DATE	07/19/85
REV DATE	04/04/95
CHG LTR	E

SHOP PRACTICE

TORQUING OF SCREW FASTENERS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-11109

PA2101-07

GENERAL VALUES: SEE 33-00109.

SPECIAL TORQUE VALUES:

FOR THE FASTENERS LISTED, USE THESE TORQUE VALUES IN PREFERENCE TO GENERAL TABLE. VALUES ARE FOR LUBRICATED THREADS.

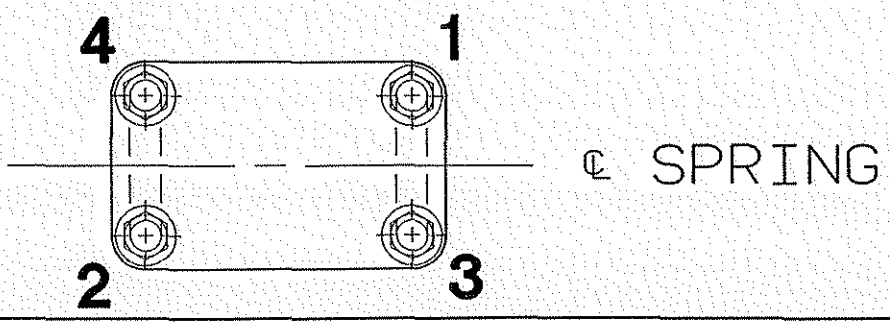
FASTENER	THREAD SIZE	GRADE MAT'L	TORQUE (FT LBS)	REMARKS (MFR)
RADIUS ROD CLAMP NUT	1/2-20 UNF	B	50-55	(FL)
HOUSING COVER TO HOUSING				(ETN)
STUD	7/16-20 UNF	8	78 ± 8	
NUT	7/16-20 UNF	C	78 ± 8	
CAP SCREW	7/16-14 UNC	5	51 ± 4	
LOCKOUT PUSH ROD NUT	3/8-24 UNF	B	23 ± 3	(ETN)
LOCKOUT SHIFT CYLINDER NUT	1/4-28 UNF	B	100 ± 10 (INCH LBS.)	(ETN)
LOCKOUT SHIFT CYLINDER MOUNTING CAP SCREW	7/16-14 UNC	5	52 ± 4	(ETN)

B "U" BOLTS ARE TO BE TORQUED DIAGONALLY FOR ALL FREIGHTLINER PROPRIETARY SUSPENSIONS (E.G. F/L AIRLINER, F/L 4 SPRING, ETC.) PER THE FOLLOWING:

"U" BOLT SIZE	STEP 1 *	STEP 2 * TORQUE TO (±20 FT-LBS.)	STEP 3 * TORQUE TO (±15 FT-LBS.)	FINAL STEP TORQUE TO (FT-LBS.)
5/8"-18 UNF	HAND TIGHTEN	60	200	180 - 230
3/4"-16 UNF	HAND TIGHTEN	60	200	270 - 330
D 7/8"-14 UNF	HAND TIGHTEN	60	200	420 - 500
E 1"-14 UNF	HAND TIGHTEN	60	200	520 - 600

* TO BE COMPLETED PRIOR TO REAR AXLE ALIGNMENT.

NOTE: "U" BOLT NUTS ARE TO BE TORQUED USING A DIAGONAL PATTERN PER THE FOLLOWING SEQUENCE:



SPECIAL TORQUE VALUES: (CONT.)

FOR THE FASTENERS LISTED, USE THESE TORQUE VALUES IN PREFERENCE TO GENERAL TABLE. VALUES ARE FOR LUBRICATED THREADS.

C

REAR AXLE YOKES

VENDOR	MODEL	FWD INPUT		FWD OUTPUT		REAR INPUT	
		THREAD SIZE	TORQUE FT.LBS.	THREAD SIZE	TORQUE FT.LBS.	THREAD SIZE	TORQUE FT.LBS.
ROCKWELL STD	R-170	———	———	———	———	1.750-12	900-1200
	SL&SQ-100, SQ-100P, SQR100 & SQR100P	1.500-12	450-600	1.250-12	450-600	1.500-12	800-1100
	SSHD	1.750-12	450-600	1.500-12	450-600	1.500-12	800-1100
	SR170	1.750-12	450-600	1.500-12	450-600	1.750-12	900-1200
	RS23-160 RS23-180 RS26-180	———	———	———	———	M45X1.5-6G	996-1232
	RS13-120 RS15-120 RS15-210 RS17-140 RS17-220 RS19-145 RS19-220 RS19-230 RS21-145 RS21-230	———	———	———	———	M32X1.5-6G	738-918
	RS23-240	———	———	———	———	M39X1.5-6G	922-1132
	RT34-145 RT40-145 RT44-145	M39X1.5 -6G	922-1132	M39X1.5 -6G	922-1132	M39X1.5 -6G	922-1132
	RT46-160	M45X1.5 -6G	996-1232	M39X1.5 -6G	922-1132	M45X1.5 -6G	996-1232
	RT48-180 RT58-180	1.750-12	900-1200	1.500-12	800-1100	M45X1.5 -6G	996-1232
	RT48-380 RT52-380 RT58-380	1.750-12	900-1200	1.500-12	800-1100	1.500-12	800-1100
	RT34-140 RT40-140	M39X1.5 -6G	922-1132	M32X1.5 -6G	738-918	M39X1.5 -6G	922-1132
EATON	D341, D381, D381P, DS451 D401P, DS402	1.625-18	780-960	1.250-12	480-600	1.500-18	560-700
	D461P D481P	1.875-12	840-1020	1.750-12	840-1020	1.750-12	840-1020
	22121	———	———	———	———	1.500-18	560-700
	23421, 23121 26121, 26421 23221 23105S E23105C	———	———	———	———	1.750-12	840-1020

*SHOP INSTALLATION OF YOKES IS NOT A RECOMMENDED PRACTICE.

COMPILED	B E	SHOP PRACTICE BRAKE INSTALLATION WEDGE-TYPE BRAKE CHAMBERS	SECTION NUMBER 33-11110
APPRV	KRH		
ISSUE DATE	12/16/68		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	K		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-008 FOR BRAKE INSTALLATION OF WEDGE TYPE BRAKE CHAMBERS.

1. Brake Installation: When installing wedge type brakes, the following steps are essential.

   A. Place wedge-roller assembly into spider. Be sure to locate nibs on wedge-roller assembly with slots in bottom of threaded hole.

      NOTE: Early Rockwell wedge brakes did not have this nib-slot arrangement.

   B. Install chamber assembly in threaded hole and screw in until tube bottoms out.

      1. Align chamber ports by backing off the chamber no more than 1 turn.

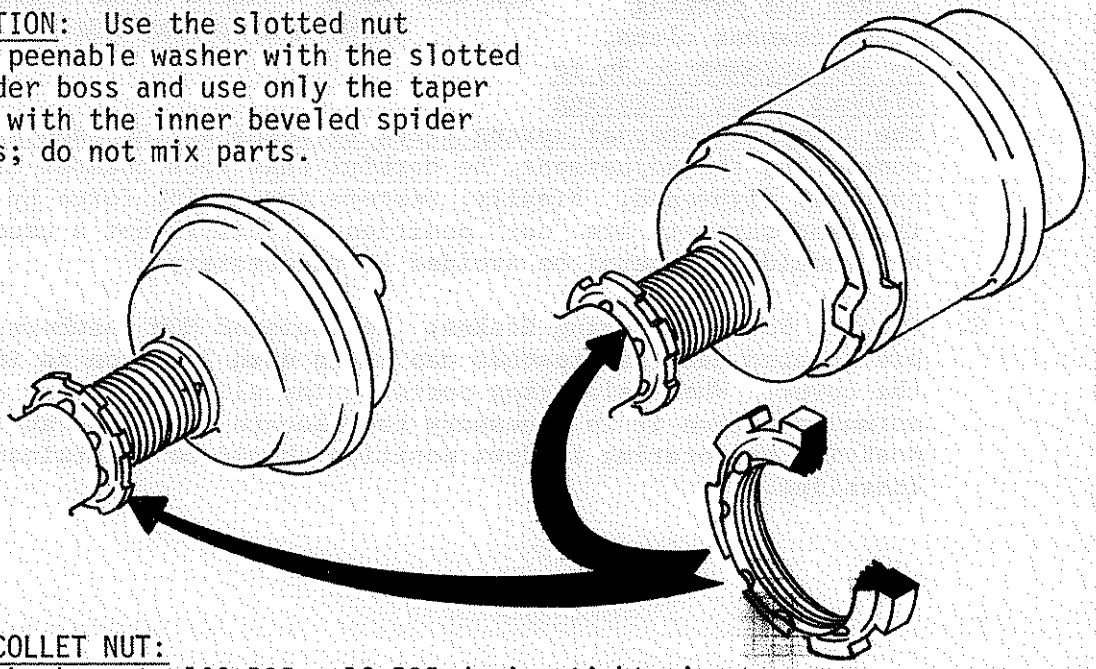
      2. Tighten the collet nut finger tight.

   C. There are two different locking methods used:

      1. On earlier models a spanner type locknut is tightened against a maleable washer which is then peened alternately into the nut slots and spider (support tube) slots.

      2. On later models a taper-nosed spanner nut enters the conical counter bore of the spider boss and, as it is tightened, effects a clamping action on the threads of the brake chamber support tube. No locking washer is used.

CAUTION: Use the slotted nut and peenable washer with the slotted spider boss and use only the taper nut with the inner beveled spider boss; do not mix parts.

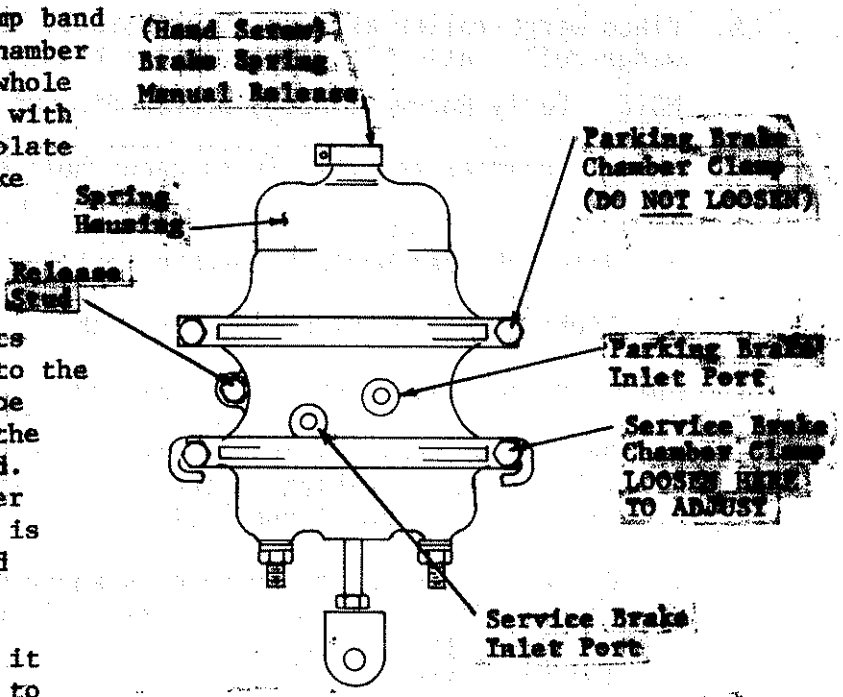


TO TIGHTEN COLLET NUT:
Charge the chambers to 100 PSI ± 10 PSI during tightening.
Use a blunt-nosed impact tool or drift punch and hammer and, after installing finger tight, rotate at least 1½ teeth. (Due to close quarters, it is not possible to use a torque wrench on this nut.)

REVISED & RETYPED " " CHANGE

2. Changing Parking Brake Chamber Inlet Port Position

It is sometimes necessary to change the direction of the air inlet ports on the spring-type air-released parking brake cylinder for better routing of the air supply hoses. This can usually be done safely and easly by (a.) loosening the clamp band on the service brake chamber and (b.) rotating the whole parking brake assembly with the attached pressure plate end of the service brake chamber. (See Sketch)



SERVICE BRAKE, PARKING BRAKE COMBINATION
(MGM, ANCHOR LOK, ETC.)

IMPORTANT CAUTIONS:

A. When the inlet ports have been rotated to the desired position, be sure to retighten the loosened clamp band. Also check the other band to be sure it is properly seated and tightened.

B. If for some reason it is found necessary to loosen the parking brake chamber clamp, do not attempt to do so without first relieving the powerful internal spring force by means of the hand screw. After completing the adjustment, be careful that both chamber clamps are properly tightened. Finally, restore the spring force by returning the hand screw to its "out" position. (This is not a usual operation and should in general be avoided as unnecessary.)

C. Special Note MGM Spring Brakes: As recieved MGM chambers have ports pre located and the breather cap is in down location as indicated on the cover. When relocating ports or installing chambers other than normal position it is necessary to relocate breather cap to down position by rotating it down position should be maintained when installed.

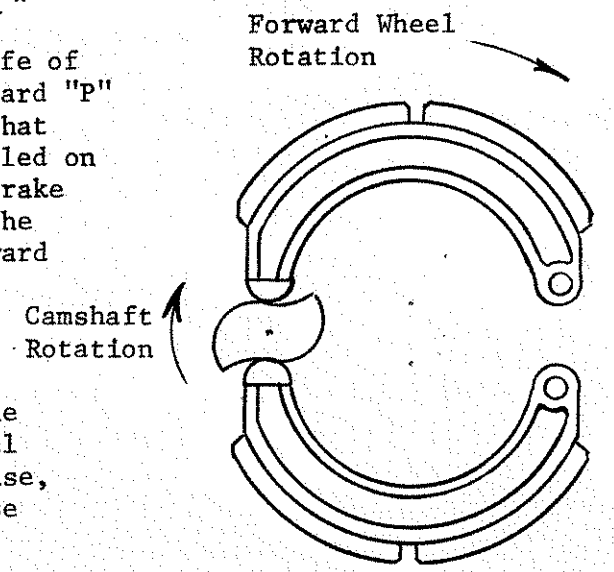
REVISED & RETYPED "C" CHG

REPORT ERRORS & CHANGES TO CORPORATE ENGINEERING

B

3. BRAKE CAMSHAFT ROTATION, TRAILER AXLES *

In the interest of improved service life of trailer axles employing Rockwell-Standard "P" series cam brakes, it is recommended that whenever possible the brakes be installed on the axle so that the rotation of the brake camshaft is in the same direction as the rotation of the wheel and drum in forward vehicle travel. (See Figure.)



Note that any installation in which the camshaft rotation is opposite the wheel and drum rotation, could result in noise, chatter, and axle "hop"; it could cause damage to the axle assembly.

C

4. BRAKE LOCATION IN SUSPENSION

D

On Hendrickson suspensions, when spring brakes are required on one axle only, they should be mounted on the forward drive axle only.

E

5. BRAKE LINING COMPATIBILITY

Brake lining from various vendors will on occasion be intermixed in inventory. Under no circumstances will an axle be assembled using lining from two different manufacturers on the same brake or the same axle. It is permissable to have different manufacturers lining on front axles to that installed on the rear axles but do not mix on Tandem axles. To facilitate identification all brake lining's are color coded see 48-2272.

F

6. SLACK ADJUSTER MATCHING

Under no circumstances is an axle to be assembled using two manufacturers' slack adjusters. The manufacturer may vary between the steering axle & the rear axles but all rear slack adjusters must be of the same manufacturer.

G

7. CAMSHAFT SPLINE LUBRICATION

Eaton brakes do not require lubrication of camshaft splines.

Rockwell brakes supplied without slack adjusters require lubrication of camshaft splines with multi-purpose chassis grease, 48-00109, prior to slack adjuster installation.

* Or, "non-drive" axles.

COMPILED	WILLIAMS	SHOP PRACTICE PROCEDURE AXLE ALIGNMENT	SECTION NUMBER 33-11111
APPRV	QUTUB		
ISSUE DATE	09/04/87		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-009 FOR AXLE ALIGNMENT PROCEDURE.

Compiled	WILLIAMS	SHOP PRACTICE AXLE ALIGNMENT PROCEDURE	33-11111
Approved	QUTUB		
Issued	9-4-87	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised	12-14-87		Page 1

A. FREIGHTLINER SPRING SUSPENSION WITH SHIM ADJUSTED RADIUS RODS

Check the initial squareness of the axle (forward axle for tandem drives) using the checking fixture. The U-bolts should be loosened and the radius rod bolts tightened (but not to their full torque).

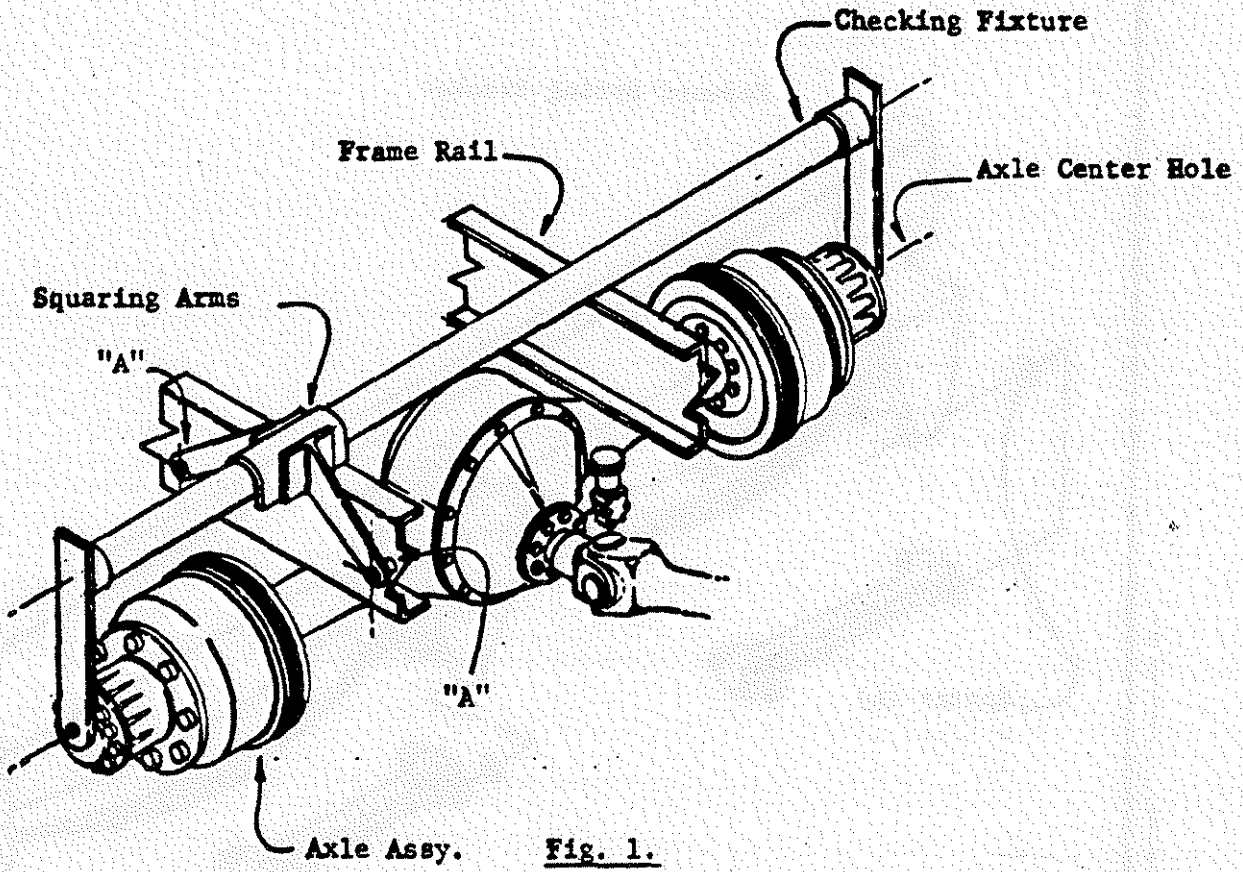


Fig. 1.

Set the checking fixture in the two center holes in the ends of the axle, and place the squaring arms on top of the cross tube. Check the squareness of the axle to the rail by noting the gap at "A" (fig. 1) between one point of of the fixture and the rail when the other point is brought in contact with the rail.

B. Washers will be needed if there is a gap of 1/16 or more under either point of the fixture. Washers should be added on the left or right side between the forward spring bracket and the radius rod (fig. 2).

B

PART NO.	NOM. THICKNESS
23-11856-042	.042"
23-09114-000	.14"

Note: Use the minimum number of washers to obtain the necessary stack thickness.

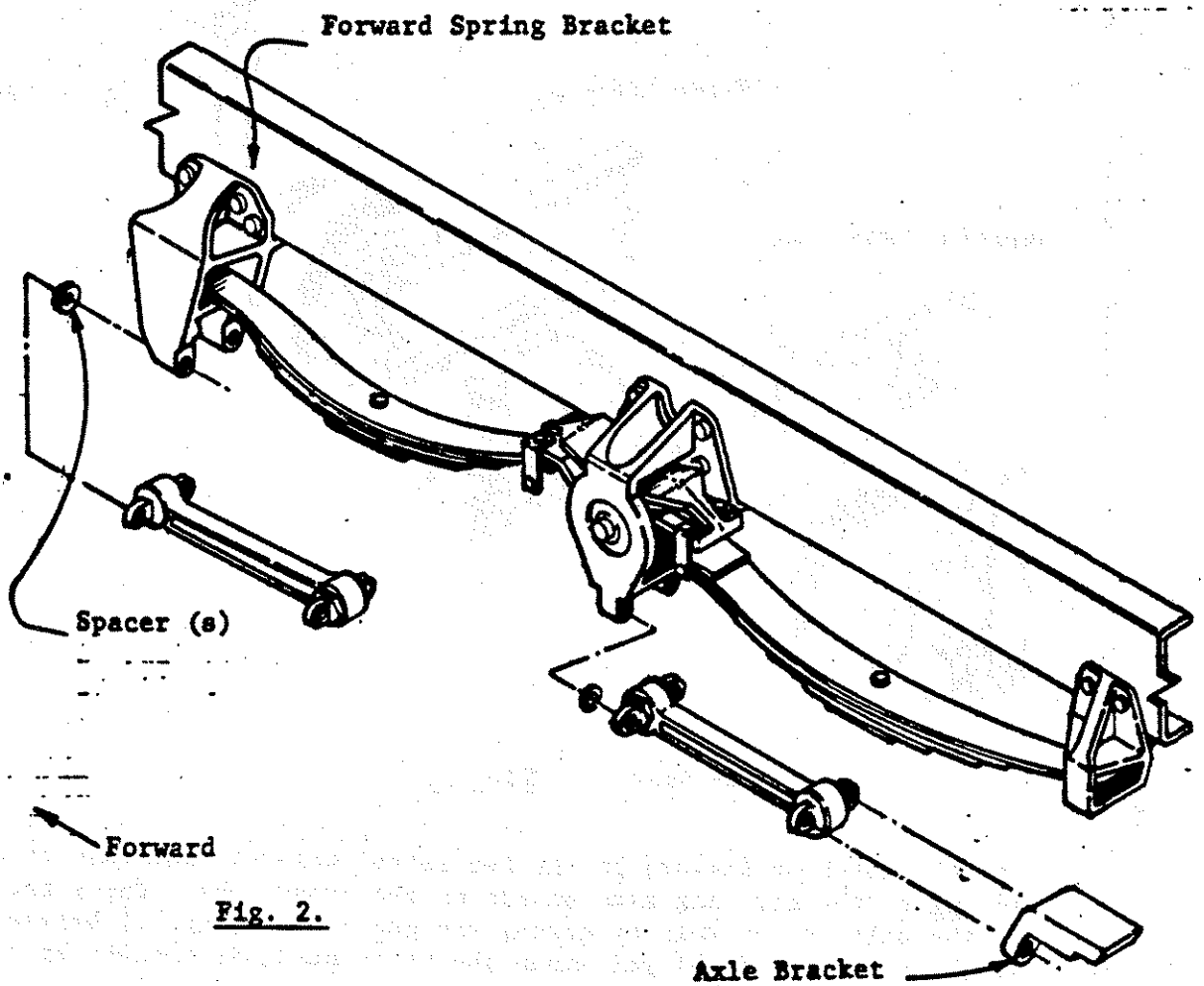


Fig. 2.

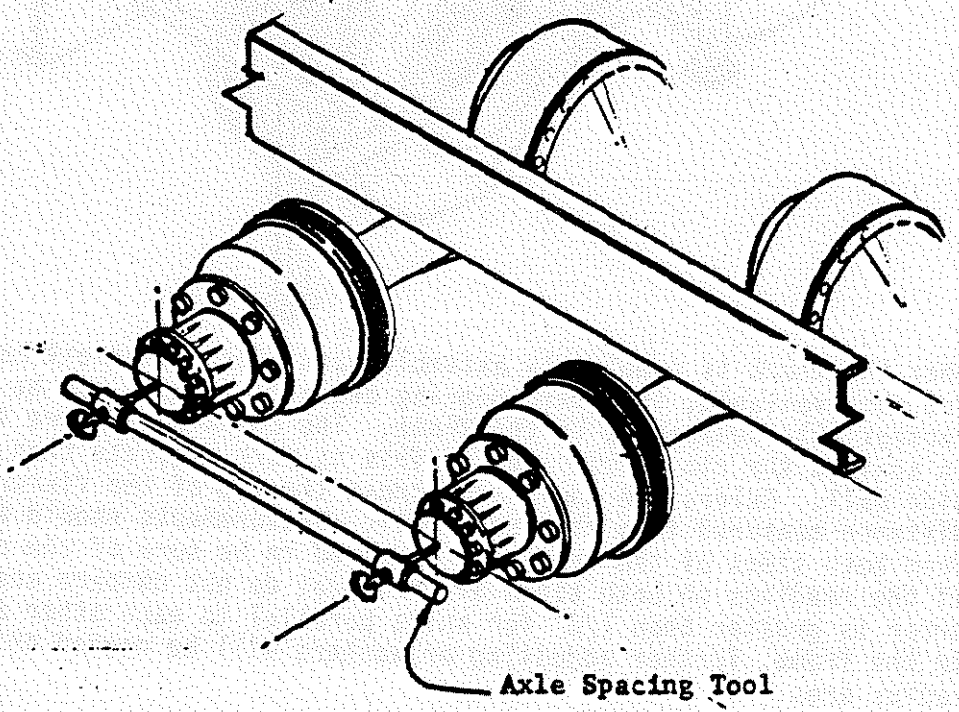
E. For tandem axle vehicles the rear axle is set parallel to the forward axle using the axle spacing tool. (fig. 3).

Set the two points of the tool in the axle center holes on one side of the vehicle and lock them in position. Transfer the tool to the other side of the vehicle and compare the axle spacing. If there is more than 1/16 difference in the spacing on one side of the vehicle compared to the other, washers must be added to the rear axle radius rods.
The washers should be located on the left or right side between the equalizer bracket and the radius rod (fig. 2).

D. When the axles have been correctly squared retorque all U-bolts and radius rods to the values per 33-16109.

E. AXLES WITH SCREW-ADJUSTED RADIUS RODS

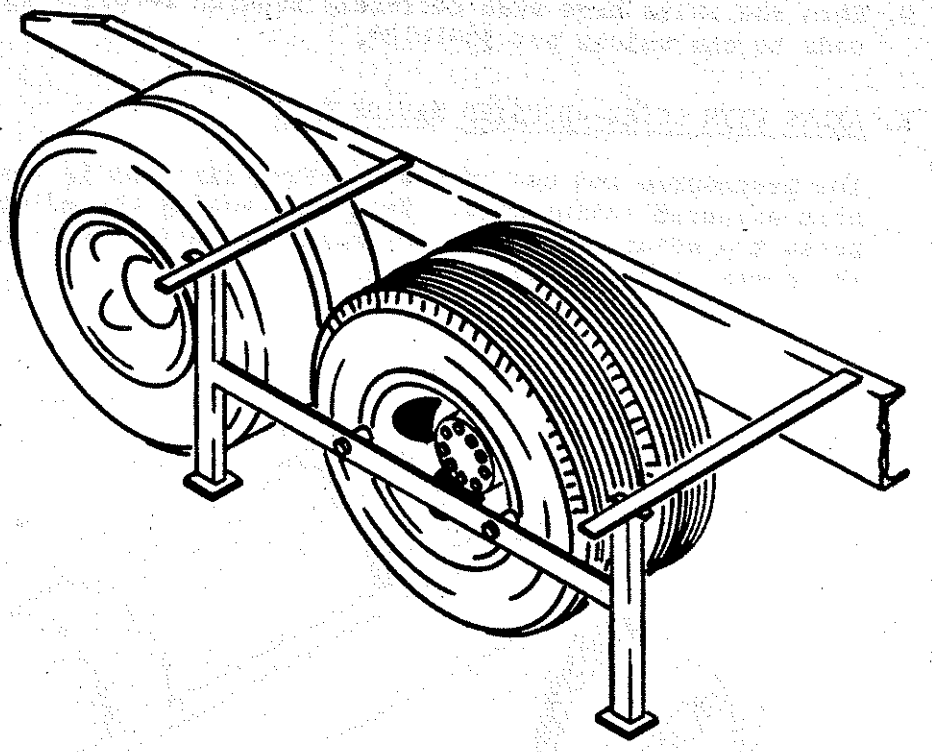
The procedures and use of the checking fixtures is the same as with the shim adjusted radius rods. Note when making the adjustment, be sure to screw the adjusting radius rod past the desired setting, and then back up the screw to the final position.



F. CHECKING AXLE SQUARENESS TO FRAME (ALTERNATE METHOD)

1. Before checking axle squareness to the frame it is very important that the truck have the rear axles in a neutral position. After location in the parked position, the truck should be run backwards and forwards several times to relax the axle position.

A



2. When the truck is completely assembled and other alignment methods are not available, the axle squaring checking fixture may be used to recheck axle squareness to the frame. The checking fixture is brought in against the rim on the wheel. This is more accurate than the tire side wall. Rulers are now layed across the top of the fixture and the distance measured into the frame rail. Measurements should be taken from both sides of the truck and compared to be sure of the readings. If the readings on both sides of the wheel do not compare and the error is greater than 1/8" for axles parallel to each other and square to the frame, further adjusting or washers will be needed on the radius arms.

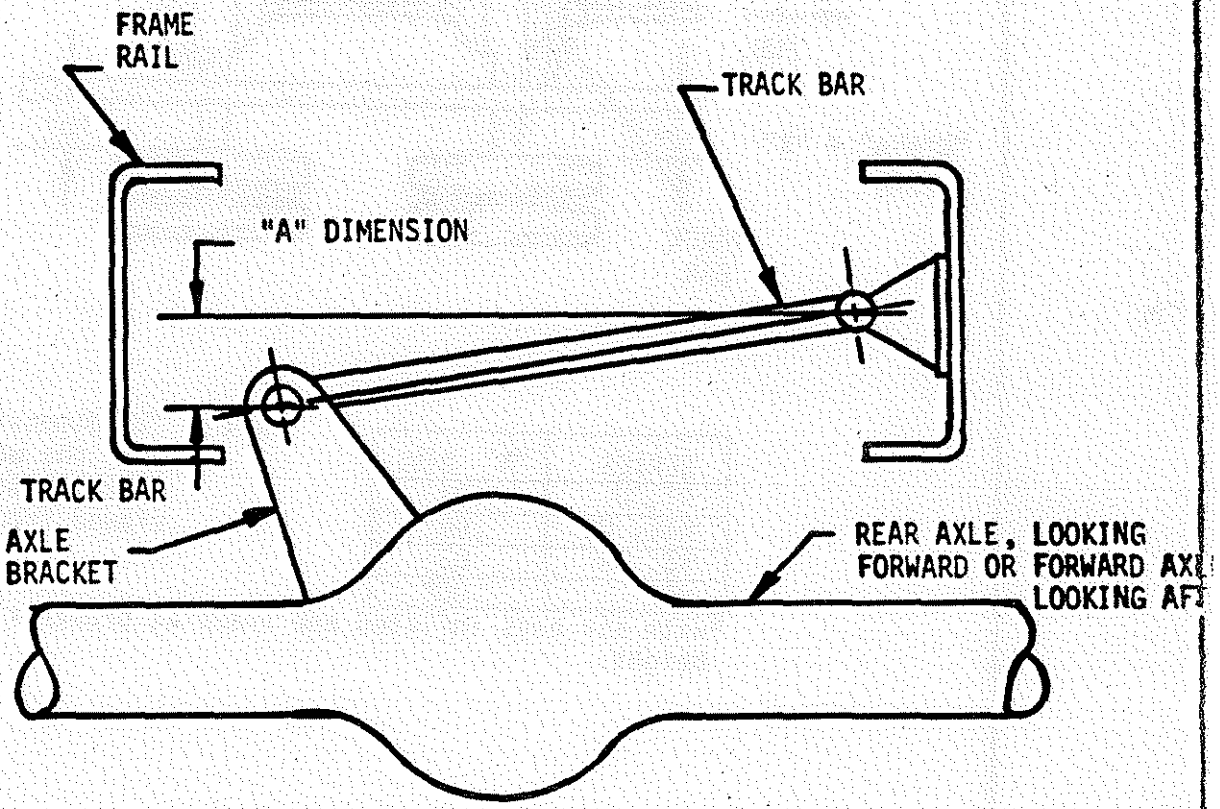
G. Hendrickson Suspensions

1. Without Track Bars/Lateral Torque Rods/Panhard Rods

The distances from the inside tire to the frame must be equal ± .12" in both loaded and unloaded conditions (with the walking beam parallel to the frame, when viewed from above).

2. With Track Bars/Lateral Torque Rods/Panhard Rods

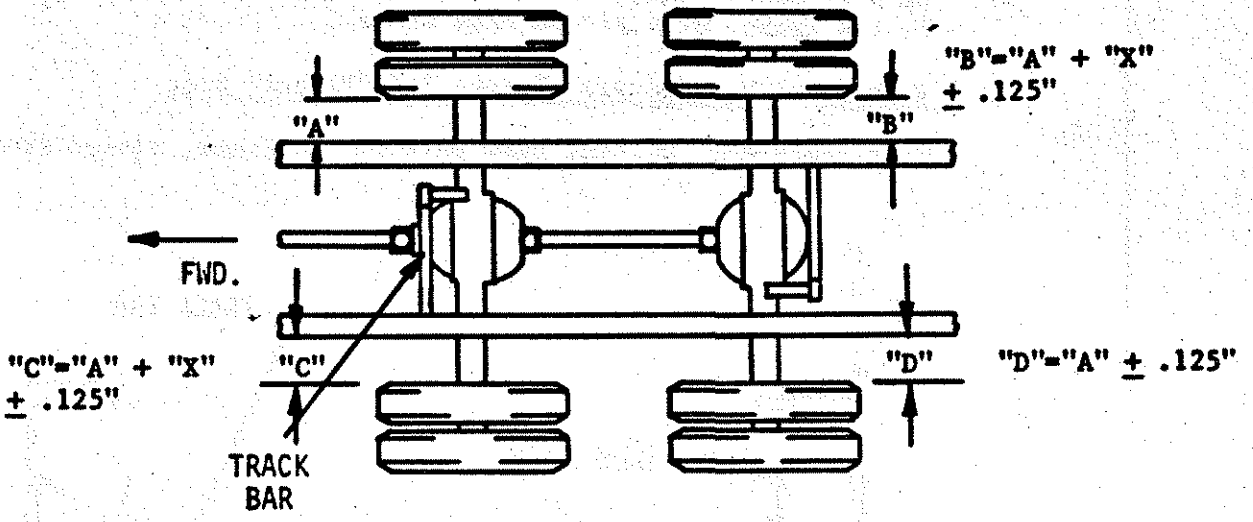
Tare condition, walking beam parallel to frame, viewed from side.



SERIES	"A" DIM.
RT	.81"
RTE-380	1.31"
RTE-440	1.00"
RS	.88"

* With air bags inflated and frame @ proper ride height.

G. HENDRICKSON SUSPENSIONS (continued)



SERIES	"X" DIM.
RT, U	.04
RTE, UE	.09
RS, SR	.03
AR	.00*

NOTE: "X" dimension applies only when the walking beam is parallel to the frame as viewed from the top.

*With air bags inflated and frame at proper ride height.

H. FREIGHTLINER AIR SUSPENSION

Checking fixture procedures are indentical to those described under 'Freightliner Spring Suspension' section A & C.

Alignment is considered satisfactory if there is a gap of 1/16" or less under either point of the checking fixture. Alignment is adjusted by installing or removing shims as described in 33-16108.

A

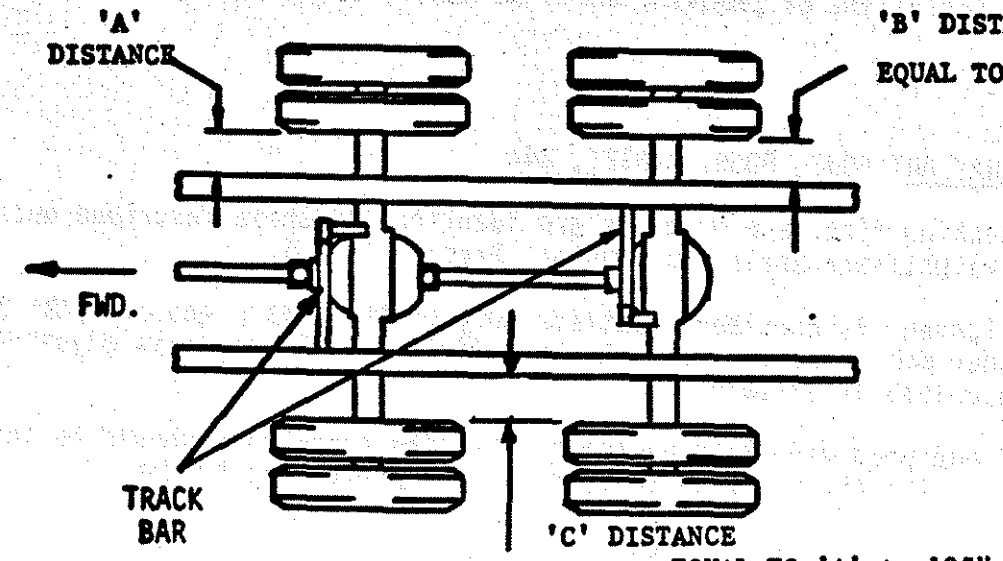
J. NEWAY ART 500B, 505B, ARD125, 244

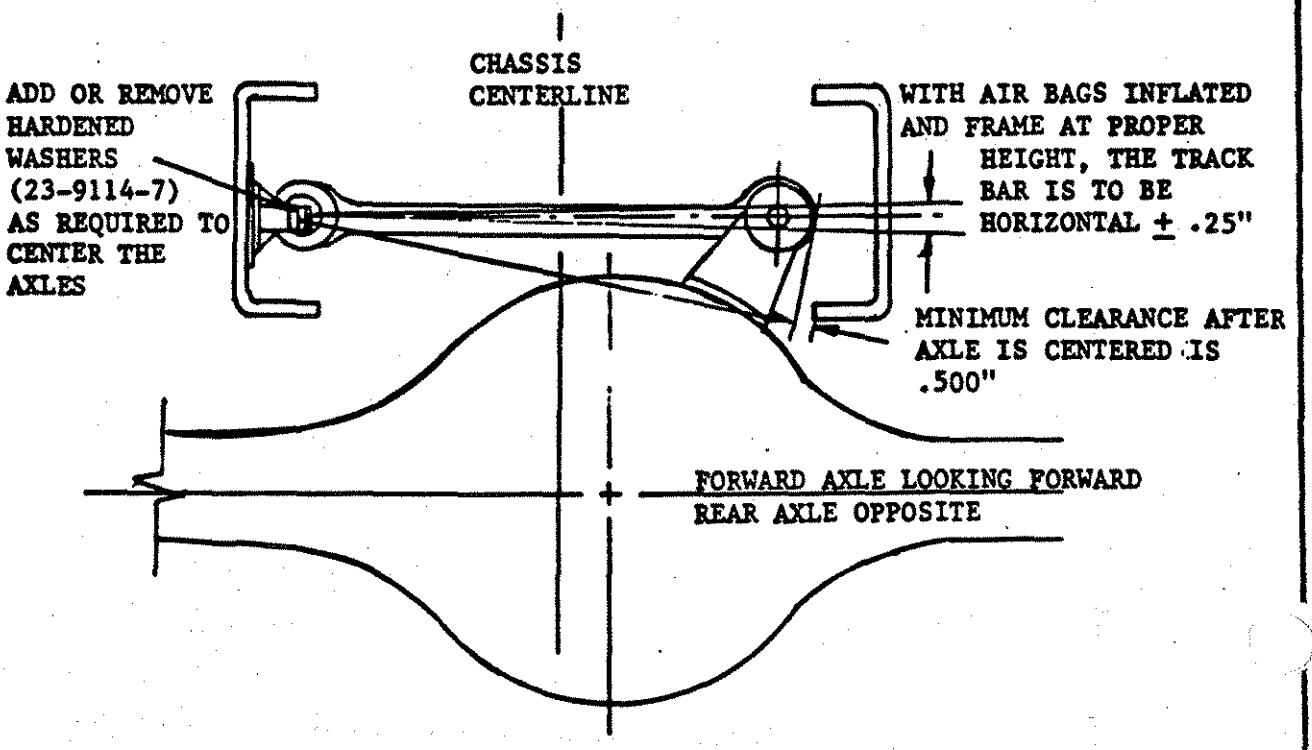
Checking fixture procedures are identical to those described under 'Freightliner Spring Suspension' Sections A & C.

Alignment is considered satisfactory if there is a gap of 1/8" or less under each point of the checking fixture. Alignment is adjusted as described in 33-16103.

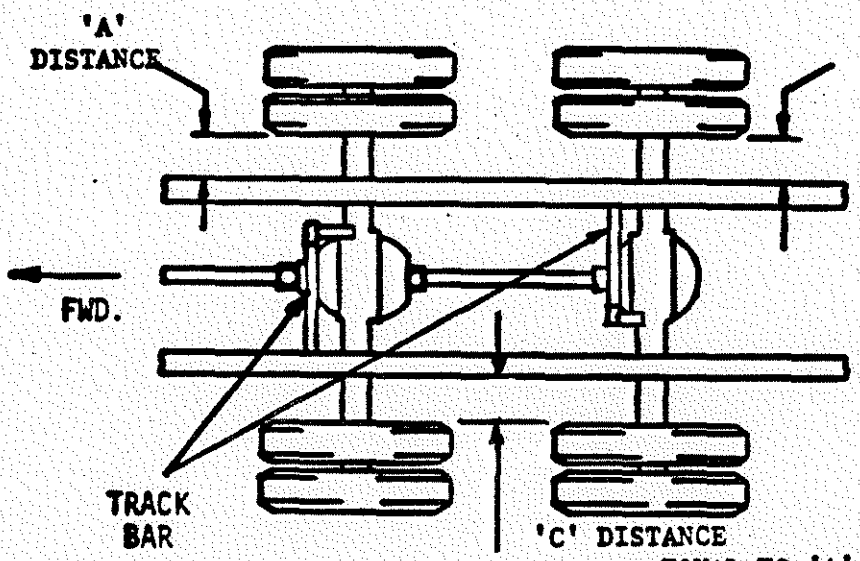
If equipped with lateral track bars, the track bars should be level ± .50 inch with the air bags adjusted to the proper bag height.

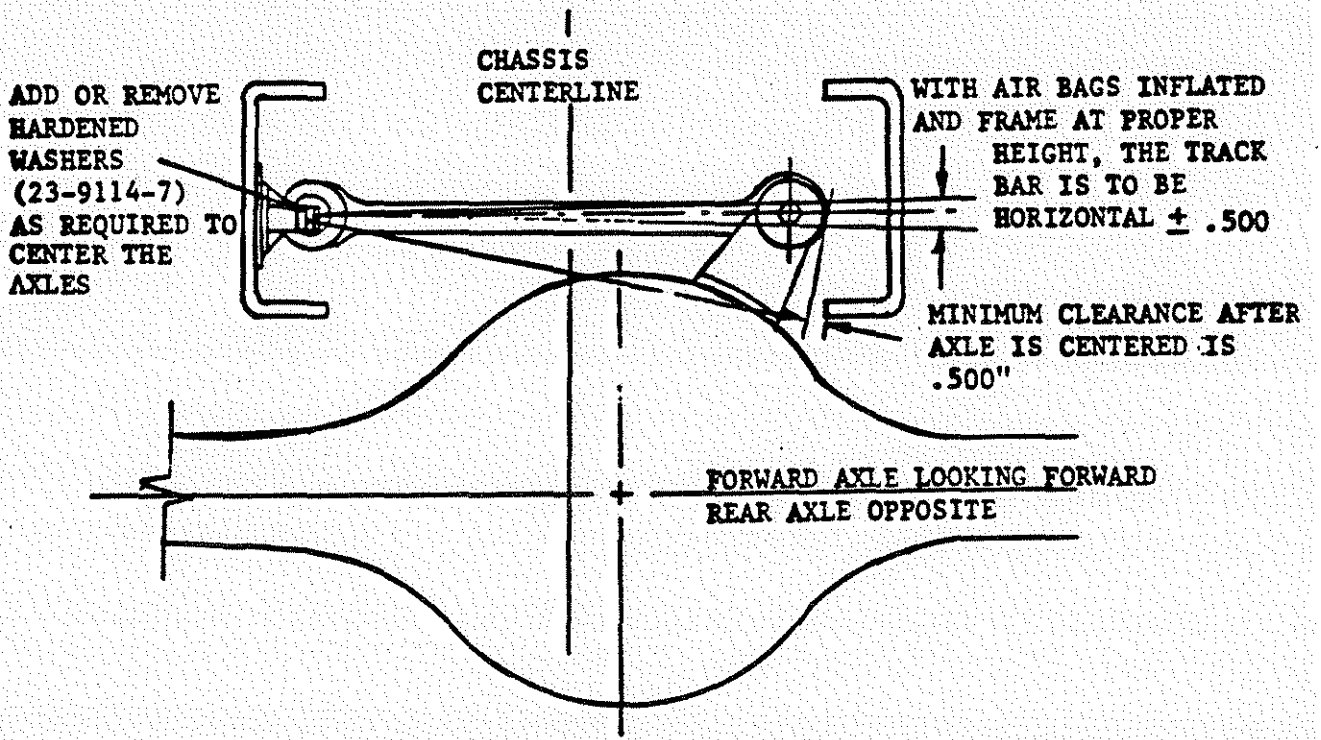
K. FREIGHTLINER AIR SUSPENSION





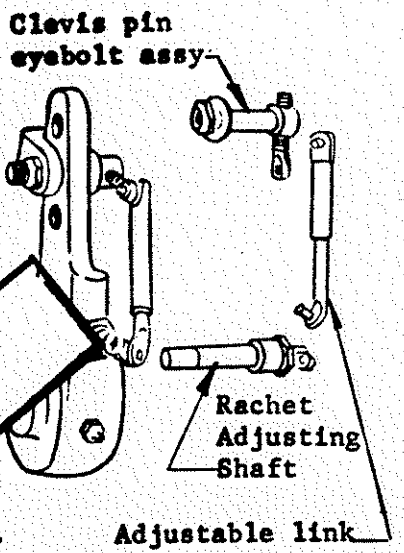
F. NEWAY AIR SUSPENSION





1. HOW THEY WORK

Automatic Slack Adjusters are designed so that each time the brakes are applied the rocking action of the slack adjuster causes the rachet head to rotate. When the travel of the push rod is sufficient for the rachet to catch the next tooth, the return stroke rotates the adjusting shaft, taking up the slack.



Length of stroke can be varied by adjustment to suit different types and uses of vehicles. Each adjustment reduces the clearance between shoe and drum by about three-thousandths of an inch. Each time the lining wears by this amount, the [illegible] will automatically adjust to compen[illegible] the wear. Since the adjustment is [illegible] the return stroke, braking pre[illegible] affected.

REMOVE & DESTROY

If need be, Automatics [illegible] manually the same as [illegible]ers. Set automatics to [illegible]t stroke anticipated for a particular vehicle and typ[illegible] example, six-inch arm automatic is normally set to adjust [illegible] pressure travel, or when lining wear is sufficient [illegible] adjustment. When the vehicle stops and the brakes cool off, the free [illegible] will then be in the same range as with the manual adjustment.

Special kits may be required for vehicles on which additional parts have been added to the slack adjuster or clevis, such as cable or rod-operated parking brakes or equalizer bars.

2. HOW TO INSTALL

To convert to Automatic brake adjustment:

(1) Replace the manual adjusting shaft with the McGregor automatic adjusting shaft.

(2) Replace the conventional clevis pin with the McGregor clevis pin-eyebolt assembly, and

(3) Connect them with the McGregor adjustable link.

When slack adjuster is already installed on the axle, note whether adjusting head faces toward or away from air chamber. Then remove and clean preliminary to installing Automatics.

A. Bendix-Westinghouse Slack Adjusters

(1) On Type 25 and Type PL-30, drill 3/16 in. diameter hole through cover plate over dowel pin, using template furnished.

(2) Remove dowel pin by driving it in toward the shaft and out the other

A. Bendix-Westinghouse Slack Adjusters (Continued)

side.

(3) Press or tap out gently, the adjusting shaft, pushing on the head and removing it from the back side, pushing out the welch plug in the process, and continuing until the shaft is free.

(4) Close dowel pin hole with knurled pin furnished with kit. Check that pin does not extend into shaft hole.

(5) Make certain the hole through the worm [illegible] line with the hole in the slack adjuster body.

(6) Using an arbor press, push McGr[illegible]nto slack adjuster until small end of shaft is 9/16" f[illegible] body. At this point, hexagon head will be appro[illegible] from contacting body of slack. (Gages are available fo[illegible].

(7) After the shaft is [illegible]osition, check to make sure that shaft and r[illegible]ly. (If the shaft does not turn easily, it is [illegible] pressed in too far or there is a mal-functio[illegible] slack adjuster.) This would be an unusual c[illegible]e present in use of the manual adjuster.

(8) Inst[illegible]rnished with kit and be sure slack adjuster i[illegible]brica[illegible]. (Unless the slack adjuster is of the permanent lu[illegible]

(9) Re-install slack adjuster on camshafts, making certain clockwise take-up rachets (with silver heads) have the rachet heads facing away from air chamber. Counter-clockwise take-up rachets (with amber heads) face toward air chamber.

(10) Turn rachet head so that the arrow stamped on it will point toward the push rod clevis. (The clevis pin hole must be aligned with the hole in the slack adjuster arm before inserting clevis pin-eyebolt assembly.) For straight arm slack adjusters, insert the clevis pin assembly into the clevis and slack adjuster arm from the side toward which the rachet head swivel fitting extends with arrow pointing toward clevis pin.

For offset arm slack adjusters, insert the clevis pin assembly from whichever side will bring the link assembly closest to a vertical position when it is installed.

(11) Install washer and start the self-locking nut on the end of the clevis pin. Before tightening nut, turn clevis pin until the eyebolt is parallel to the push rod. The eyebolt head should extend away from the air chamber for clockwise take-up rachet or toward it for a counter-clockwise take-up rachet. Care must be taken to hold eyebolt parallel to the push rod while tightening the nut. Tighten until head of clevis pin is drawn against the clevis. Then back nut off one half turn to prevent binding between the clevis and the slack arm.

REMOVE & DESTROY

A. Bendix-Westinghouse Slack Adjusters (Continued)

(12) Install link assembly. Before installing washers and cotter pins, adjust the length of the link assembly so that the arrow on the rachet head is parallel to the link when brake is in full OFF position. Install washers and cotter pins.

NOTE------If interference from adjacent parts makes it impossible to insert the clevis pin as described above, the clevis pin may be inserted from the opposite side. But the arrow head must still point toward the clevis, and the arrow must still be parallel to the link. This is accomplished by adjusting the length of the link. Likewise, the arrow must still point toward the push rod clevis and must be parallel to the link when the push rod is in full OFF position. Whether the slack adjuster is mounted upright, inverted or horizontal on the vehicle makes no difference.

(13) If there is more than 1/16" clearance between shoe and drum, adjust manually until gap measures approximately 1/16". Automatic adjusters will make any further adjustment. To take up slack manually, simply turn hex nut in proper direction. To back off slack manually, the pawl must be pushed in by hand toward the slack adjuster while backing off.

(14) With full air tank, operate brakes slowly several times until automatic adjustment occurs. At this point, measure the length of travel of the push rod under full air pressure. As an example, push rod travel should be about 1-3/4" for a 5" arm slack adjuster, and 2" for a 6" arm slack adjuster.

Push rod travel should be within 1/8" on all brakes of a given vehicle. If not within this range, correct by disconnecting link from eyebolt and by turning eyebolt in (clockwise) to lengthen stroke; out (counter-clockwise) to shorten stroke. One full turn of eyebolt will change the length of stroke approximately 1/16". (After this adjustment, it may be necessary to change the length of the link in order to make the link parallel with the arrow, as described in Paragraph 10.)

After changing position of eyebolt and after adjusting link, the slack adjuster should be backed off to 1/16" shoe-to-drum clearance. Then re-check push rod travel to assure it remains within the 1/8" range. The McGregor adjuster will provide any further required adjustment.

(15) When vehicle is in full-load service, further automatic adjustment will occur. After this initial service, push rod travel should be rechecked. If the stroke is not as desired, the eyebolt should be turned in (clockwise) to lengthen the stroke; out (counter-clockwise) to shorten the stroke, following the procedure set forth in Paragraph 14.

B. Midland-Ross (or Truehauf-Strick) Slack Adjuster

(1) With pointed punch, drive a hole about 7/32" diameter through one

REMOVE & DESTROY

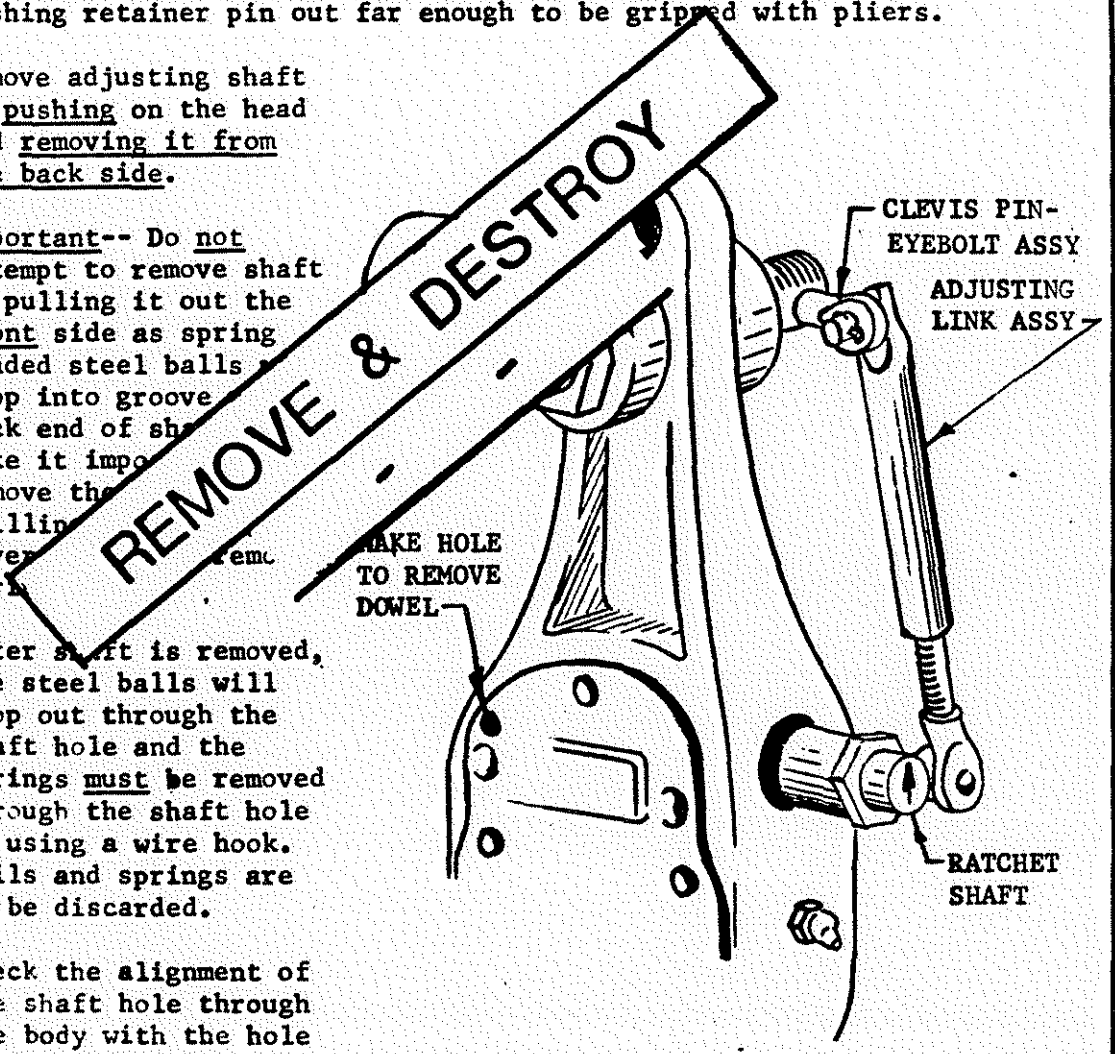
B. Midland-Ross (or Fruehauf-Strick) Slack Adjuster ((1) Continued)

cover plate at point over dowel pin as located by template included in kit. Be sure hole is over pin and large enough to allow pin to come out.

(2) Remove retainer pin by tapping slack adjuster with the pin downward. If this fails, use pointed punch to make indentation in back cover plate, pushing retainer pin out far enough to be gripped with pliers.

(3) Remove adjusting shaft by pushing on the head and removing it from the back side.

Important-- Do not attempt to remove shaft by pulling it out the front side as spring loaded steel balls drop into groove back end of sh make it impo remove th drillin cover sprl emo



(4) After shaft is removed, the steel balls will drop out through the shaft hole and the springs must be removed through the shaft hole by using a wire hook. Balls and springs are to be discarded.

(5) Check the alignment of the shaft hole through the body with the hole through the worm. Insert the rachet in place of the original adjusting shaft (making sure the flats on the shaft are aligned with the flats in the worm gear), pushing in until the circular groove in the shaft lines up with the retainer pin hole in the body. If properly aligned, the shaft should slip in easily.

(6) Insert knurled retainer pin (furnished with kit) into the hole in the body (smooth end first); then drive it in until the head is flush with the outside of the cover plate.

(7) Rotate the shaft sufficiently to be sure there is no binding or ex-

*Adapted from instruction bulletin of McGregor Automatic Slack Adjusters, Carlodge Corporation

B. Midland-Ross (or Fruehauf-Strick) Slack Adjuster (7) Continued

cessive friction. If there should be binding or friction, it may be necessary to "run it in", using an electric drill or some other suitable means.

Important--Shaft must turn freely for Automatics to work properly.

For additional instructions, see paragraphs 9 through 15 under Bendix-Westinghouse.

REMOVE & DESTROY

Compiled	B. Evens	SHOP PRACTICE BRAKE TUBE SUPPORT BRACKET LOCATION	33-11113
Approved	JRS		
Issued	8-26-66		
Revised	5-11-82	Chg Ltr G FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-20

G

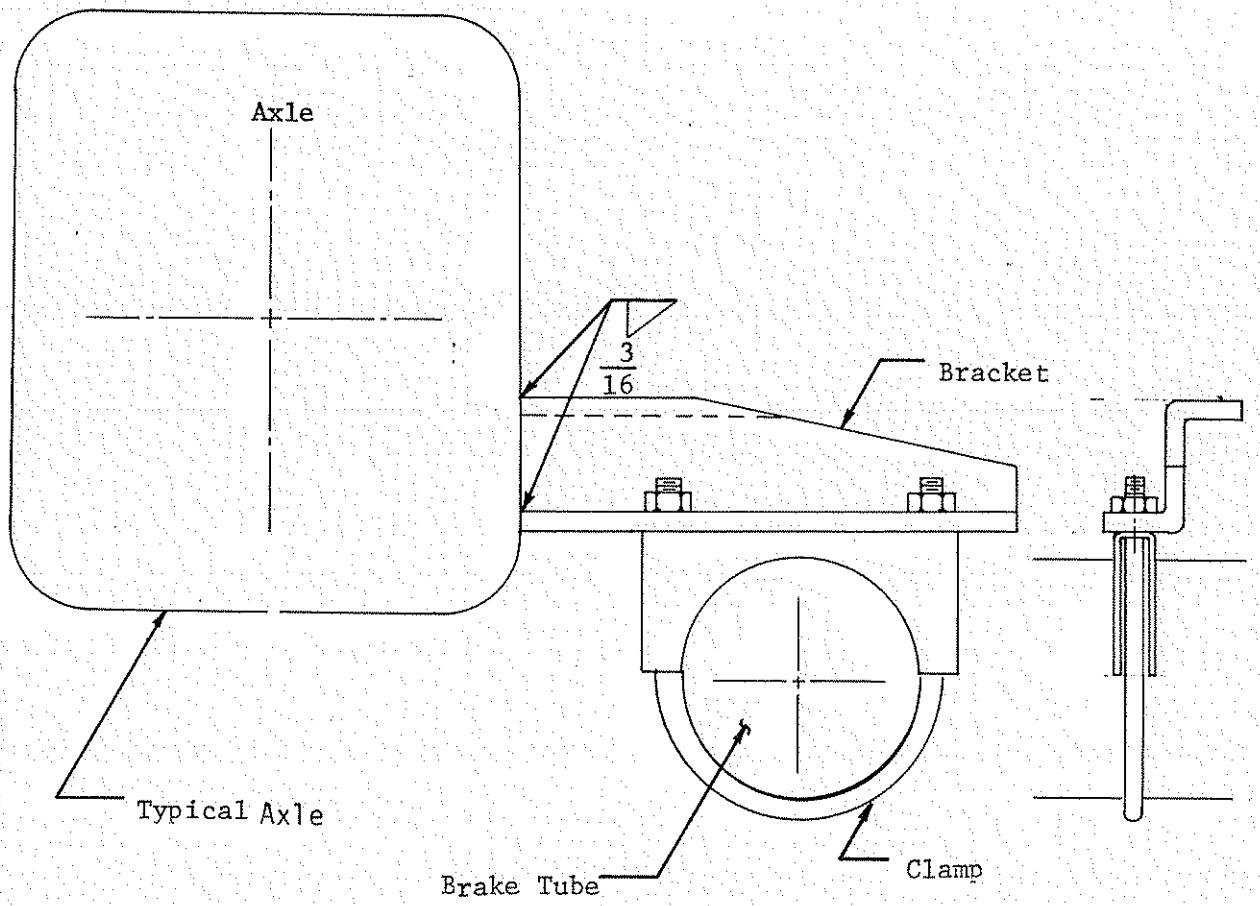
C. INSTALLATION

1. Attach clamp and bracket loosely on brake tube as shown.

2. Position bracket for proper weld to axle housing and tighten clamp just enough to hold snugly.

3. Weld per instructions in 33-11103

NOTE: Position bracket as close as possible to the base of the chamber.



COMPILED	HADDOCK	SHOP PRACTICE INSTALLATION BRAKE, REAR AXLE	SECTION NUMBER 33-11114
APPRV	DRS		PAGE 1 OF 1
ISSUE DATE	06/14/67	FREIGHTLINER CORPORATION PORTLAND, OREGON	P4435N-01
REV DATE	07/07/94		
CHG LTR	K		

BRAKE INSTALLATION

CAM AND WEDGE BRAKES ARE TO BE ASSEMBLED TO THE AXLE FLANGE USING THE FASTENERS LISTED IN THE BILLS OF MATERIALS.

1. TIGHTENING SEQUENCE

J 1.1 THE BRAKE IS TO BE ASSEMBLED TO THE AXLE FLANGE WITH THE SPECIFIED FASTENERS AND THEN THE FASTENERS TIGHTENED TO THE FINAL TORQUE VALUE IN EITHER OF THE SEQUENCES SHOWN IN FIGURE 1.

1.1.1 WITH THE USE OF A TOOL, SNUG TIGHTEN THE FIRST FASTENER.

1.1.2 TIGHTEN THE REMAINING FASTENERS TO:

K 5/8-11 HEX CAPSCREW ..... 145 ±15 FT.LBS.

5/8-11 HEX FLANGE HEAD CAPSCREW ..... 180 ±20 FT.LBS.

1.1.3 TIGHTEN THE FIRST FASTENER TO THE SPECIFIED FINAL TORQUE VALUE.

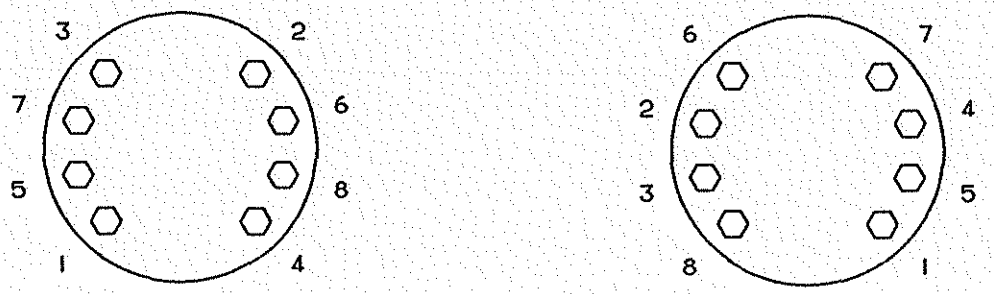
J 

FIGURE 1

TIGHTENING SEQUENCES

Compiled	K. HADDOCK	SHOP PRACTICE	33-11115
Approved	DRS	OIL LEVEL HOLE LOCATION	
Issued	10-4-71		
Revised	1-30-84	Chg Ltr D FREIGHTLINER CORPORATION PORTLAND, OREGON	

C

ROCKWELL AXLES

The proper oil level is at the bottom of the fill plug hole as follows:

AXLE PLANNING ANGLE	PLUG LOCATION
0^{o} to $+7^{o}$	CARRIER SIDE
$+8^{o}$ to $+13^{o}$	REAR AXLE HOUSING

EATON AXLES

The proper oil level is at the bottom of the fill plug hole in the rear axle housing.

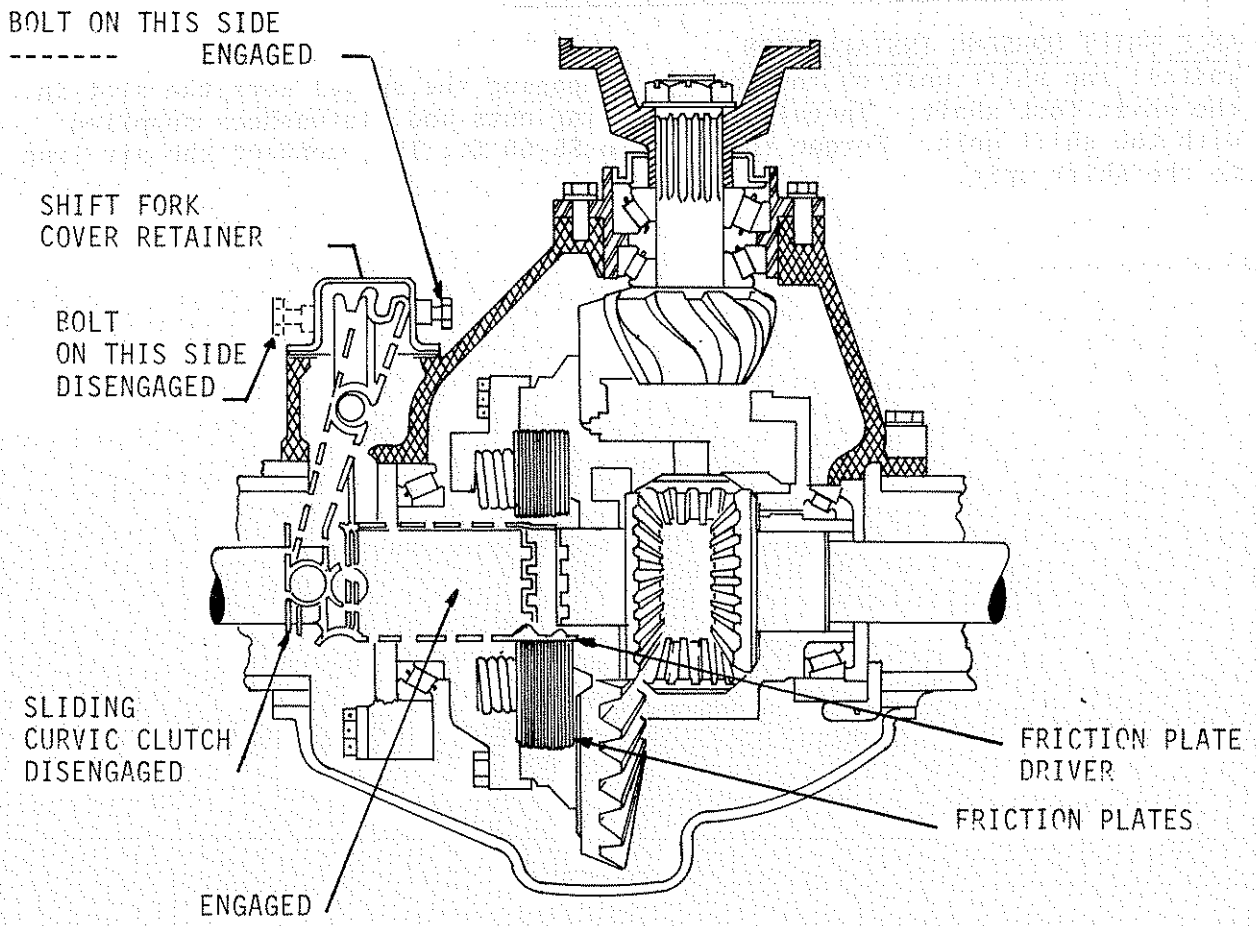
D When the axle planning angle exceeds 10^{o} a standpipe must be added to the axle. A standpipe is an elbow extending out and up from the axle's oil filler hole to a point even with a desired fill level. To raise the lube level 2" for example, mark a point 2" above the base of the filler hole in the rear cover of the axle housing and install a pipe elbow sized to be even with the mark. When filled, oil will rise in the axle to a point level with the top of the standpipe, providing extra lubrication to compensate for extreme operating angles.

The chart below gives standpipe length requirements.

Installation Angle	FWD Tandem Axle	Rear Tandem or Single Drive
Over 10^{o} less than 13^{o}	1.50 inch	---
Over 13^{o} less than 15^{o}	1.75 inch	1.00 inch
15^{o}	2.50 inch	2.00 inch

D

EATON DRIVE AXLE MODEL 23421, 44 DSM, 44 RSM (23421 ILLUSTRATED)



CARRIER ASSEMBLY WITH SEASONAL ENGAGEMENT TYPE COVER RETAINER

The axle is shipped from the manufacturer with the curvic clutch disengaged.

If the customer requests factory engagement, position the curvic clutch in the engaged position, then install shift fork cover retainer with the adjusting screw facing the carrier (in this position the adjusting screw keeps the sliding curvic clutch engaged).

Secure with flat washers and self-locking nuts.

CAUTION: When engaging, be sure to raise and rotate one wheel to help teeth engage.

A. PRECAUTIONARY MEASURES

1. It is imperative for safe and satisfactory operation of not only the automatic slack adjuster, but the brake itself, that after installation, the slack adjuster will operate from full release position to full air chamber stroke position without any interference with adjacent chassis components such as axle housing or suspension members. Should interference be encountered, corrective measures to eliminate the interference, appropriate to the specific circumstances, must be taken before this installation can be completed. However, under no circumstances shall the slack adjuster be modified in any way whatsoever.

2. When necessary to weld in the area of the automatic slack adjuster, take adequate precautions to protect the rubber boot.

3. Never abruptly strike the side cover when installing slack adjuster since it may distort causing seal leakage.

B. INSTALLATION PROCEDURE

1. Remove manual slack adjuster and clevis from air chamber push rod.

2. Using 1/4 inch male hex wrench, remove pipe plug from automatic slack adjuster housing to expose worm shaft.

3. Preposition splines in automatic slack adjuster by turning worm shaft manually clockwise with 1/4 inch male hex wrench as necessary so that slack adjuster will start onto camshaft approximately as shown in Figure 1. (This operation must be done while new clevis is still installed on automatic slack adjuster.

   NOTE: Positively do not attempt to turn worm shaft manually with clevis disconnected from drive link.

A

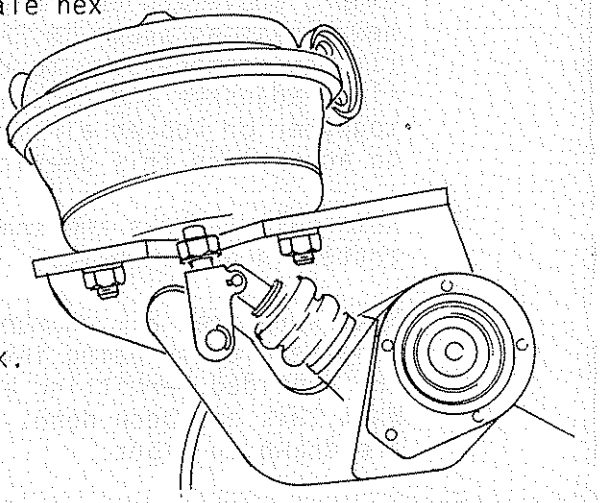
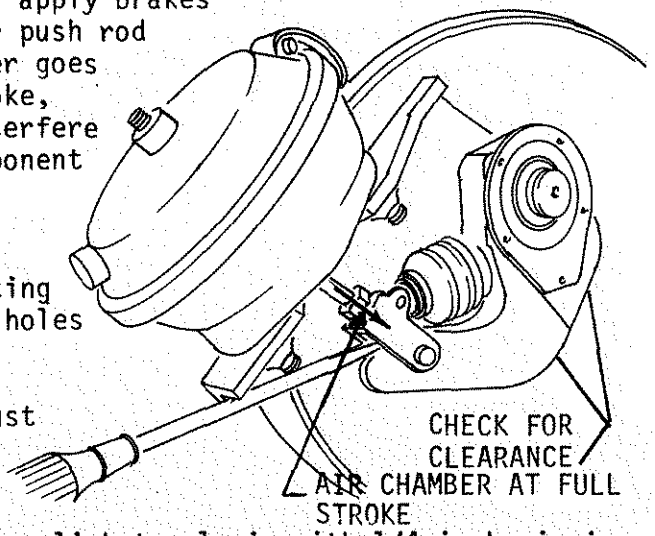


FIGURE 1.

B. INSTALLATION PROCEDURES (Continued)

10. Pull slack adjuster by hand or apply brakes from cab to extend air chamber push rod full stroke. As slack adjuster goes from full release to full stroke, make sure that it does not interfere with any adjacent chassis component such as a part of the axle or suspension. See Figure 4.

FIGURE 4.



11. Align 1/4 inch hole in connecting drive link with corresponding holes in clevis. (Link will rotate slightly as it is slid into position with clevis. This must be overcome by rotating worm shaft.

12. Connect automatic adjuster drive link to clevis with 1/4 inch pin in same manner that it was when received on new automatic slack adjuster. Install cotterpins on both ends, if required.

    NOTE: The pin furnished is hardened and ground. To insure satisfactory adjuster operation, a substitute pin must not be used.

13. Tighten jam nut against clevis on air chamber push rod.

14. Adjust brake by turning worm shaft clockwise with 1/4 inch male hex wrench until shoes are tight against drum; then back off approximately 3/4 turn counter-clockwise.

15. Reinstall 1/4 inch pipe plug.

16. Recheck to insure that:

    a. Slack adjuster is in position per Figure 1.
    b. Jam nut is tight against clevis.
    c. Camshaft snapring or cotterpin and washers are securely installed.
    d. Air chamber is located properly and securely tightened to mounting bracket.
    e. Cotterpin is installed in 1/2 inch clevis pin.
    f. Cotterpin is installed in 1/4 inch link pin.
    g. Pipe plug is securely installed in adjuster.
    h. Slack adjuster is free to operate up to full air chamber stroke without encountering any interference.

17. To release brake, turn worm shaft counter-clockwise with 1/4 inch male hex wrench.
    NOTE: Backing slack adjuster off requires much more force than adjusting.

COMPILED	ERK	SHOP PRACTICE INSTALLATION OF ROCKWELL AUTOMATIC SLACK ADJUSTERS	SECTION NUMBER 33-11118
APPRV	JSB		
ISSUE DATE	08/26/88		PAGE 1 OF 4
REV DATE	06/21/95	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PH0706-02

PURPOSE:

TO PROVIDE A PROCEDURE FOR THE INSTALLATION OF ROCKWELL AUTOMATIC SLACK ADJUSTERS AT TRUCK ASSEMBLY.

ABSTRACT:

THIS STANDARD DEFINES A DETAILED PROCEDURE FOR REAR AXLE INSTALLATION OF 5 1/2 INCH AND 6 INCH ROCKWELL AUTOMATIC SLACK ADJUSTERS (ASA'S) TO ROCKWELL OR EATON CAM BRAKE ASSEMBLIES.

D NOTE: ROCKWELL AUTOMATIC SLACK ADJUSTERS INSTALLED ON MGM LONG STROKE CHAMBERS, WITH WELDED CLEVIS, DO NOT REQUIRE CLEVIS ADJUSTMENT.

SCOPE:

THIS SHOP PRACTICE PRESCRIBES FREIGHTLINER'S REQUIREMENT FOR THE ASSEMBLY OF ROCKWELL AUTOMATIC SLACK ADJUSTERS TO EATON AND ROCKWELL CAM BRAKE ASSEMBLIES, INCLUDING PROCEDURES, THE INITIAL SETTINGS, AND OPERATING CONDITIONS. THE PRACTICE SHALL BE IN EFFECT IN THE ABSENCE OF SPECIFIC ENGINEERING DIRECTION.

RESPONSIBILITY:

ALL PERSONNEL RESPONSIBLE FOR THE INSTALLATION OF, OR THE ACCEPTANCE OF, ROCKWELL AUTOMATIC SLACK ADJUSTERS FITTED TO EATON OR ROCKWELL CAM BRAKE ASSEMBLIES SHALL BE RESPONSIBLE FOR ADHERENCE TO THIS PROCEDURE.

SPECIFICATION:

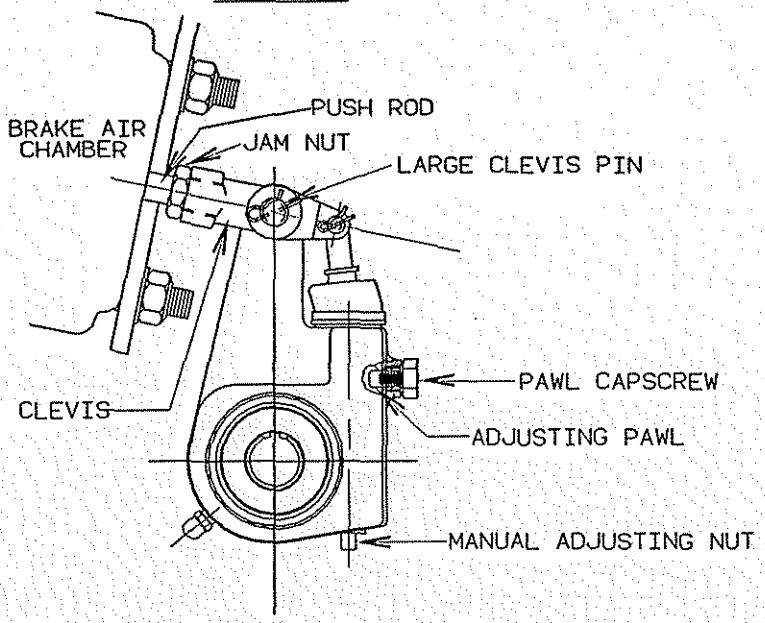
1. PRECAUTIONARY MEASURES

1.1 IT IS IMPERATIVE FOR SATISFACTORY OPERATION OF NOT ONLY THE ASA, BUT THE BRAKE ITSELF, THAT AFTER INSTALLATION THE SLACK ADJUSTER WILL OPERATE FROM FULL RELEASE POSITION (CHAMBER PUSH ROD FULLY RETRACTED) TO FULL AIR CHAMBER STROKE POSITION (CHAMBER PUSH ROD FULLY EXTENDED) WITHOUT ANY INTERFERENCE WITH ADJACENT CHASSIS COMPONENTS SUCH AS AXLE HOUSING OR SUSPENSION MEMBERS. SHOULD INTERFERENCE BE ENCOUNTERED, CORRECTIVE MEASURES TO ELIMINATE THE INTERFERENCE, APPROPRIATE TO THE SPECIFIC CIRCUMSTANCES, MUST BE TAKEN BEFORE THIS INSTALLATION CAN BE CONSIDERED COMPLETE. UNDER NO CIRCUMSTANCES SHALL THE SLACK ADJUSTER BE MODIFIED IN ANY WAY WHATSOEVER.

1.2 IF IT IS NECESSARY TO WELD IN THE AREA OF THE AUTOMATIC SLACK ADJUSTER, TAKE ADEQUATE PRECAUTIONS TO PROTECT THE RUBBER BOOT AGAINST WELD SPATTER.

1.3 THE MANUAL ADJUSTING NUT TURNS WITH MINIMAL RESISTANCE IN ONE DIRECTION ONLY. DO NOT FORCE IT AGAINST RESISTANCE ANYTIME DURING INSTALLATION OR ADJUSTMENT.

FIGURE A



2. INSTALLATION PROCEDURES:

2.1 ASSEMBLE BRAKE CHAMBER TO BRAKE ASSEMBLY BRACKET MAKING CERTAIN IT IS PROPERLY POSITIONED.

2.1.1 DO NOT INSTALL ANY WASHERS BETWEEN CHAMBER AND BRACKET.

C 2.1.2 BRAKE CHAMBERS ARE TO BE IN A FULLY CAGED CONDITION WHEN RECEIVED FROM THE VENDOR.

2.2 SELECT THE PROPER ASA GAUGE AS DETERMINED FROM TABLE I (SEE EXAMPLE GAUGE FIGURE B). POSITION AND MAINTAIN THE GAUGE AGAINST THE FACE OF THE CHAMBER AND AROUND THE PUSH ROD UNTIL THE COMPLETION OF PROCEDURE 2.5. THREAD THE CLEVIS JAM NUT ON THE PUSH ROD UNTIL IT MAKES CONTACT WITH THE GAUGE (SEE FIGURE C). THREAD THE CLEVIS ON THE PUSH ROD AND FINGER TIGHTEN AGAINST THE JAM NUT.

TABLE I

BRAKE TYPE	GAUGE
ROCKWELL, -----	ROCKWELL - .415
EATON, ----------	EATON - .540

FIGURE B

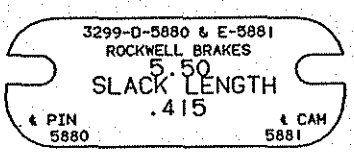
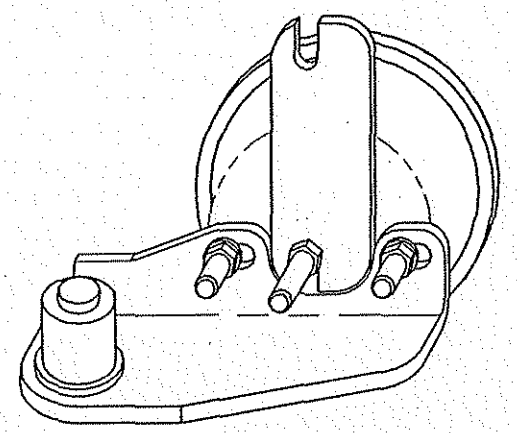


FIGURE C



C 2.2.1 THE CLEVIS IS TO BE THREADED ON THE PUSH ROD WITH +1/8"/-1/4" OF FULL THREAD ENGAGEMENT AND ALIGNED TO ACCEPT THE SLACK ADJUSTER ARM

NOTE: PROCEED TO STEP 2.4.4 IF THE BRAKE ASSEMBLY IS RECEIVED WITH THE ASA FACTORY INSTALLED.

2.3 REMOVE SNAP RING, WASHERS, AND SPACER FROM CAMSHAFT. COAT THE CAMSHAFT SPLINES WITH A HIGH TEMPERATURE WATER PROOF GREASE, NLGI GRADE NO #1 OR #2. CHASSIS LINE GREASE, 48-00109-001, SATISFIES THIS REQUIREMENT.

2.4 INSTALL THE AUTOMATIC SLACK ADJUSTER ONTO THE CAMSHAFT SPLINE POSITIONING THE SLACK ADJUSTER SO THAT THE ADJUSTER ACTUATOR ROD IS ON THE SIDE AWAY FROM THE CHAMBER WITH THE SLACK ADJUSTER ARM JUST CLEARING THE CLEVIS.

2.4.1 ALWAYS INSTALL THE SLACK ADJUSTER SO THAT THE ADJUSTING PAWL CAPSCREW IS ACCESSIBLE, PERPENDICULAR TO THE AXLE OR FACING TOWARDS THE VEHICLE CENTERLINE.

2.4.2 INSTALL SPACING WASHERS, AS REQUIRED, ON THE CAMSHAFT TO POSITION THE SLACK ADJUSTER ON THE CAMSHAFT IN LINE WITH THE AIR CHAMBER PUSH ROD, WITH MAXIMUM END PLAY OF 1.6MM (.062") ALONG THE CAMSHAFT.

2.4.3 SECURE THE SLACK ADJUSTER TO THE CAMSHAFT BY INSTALLING SNAP RING.

C 2.4.4 ROTATE THE ASA ON THE CAMSHAFT BY TURNING THE MANUAL ADJUSTING NUT ON THE BOTTOM OF THE ASA WITH A 5/16" WRENCH UNTIL THE ADJUSTER ARM ROTATES INTO THE CLEVIS WITH THE LARGE HOLES IN THE ADJUSTER ARM AND THE CLEVIS ALIGNED.

2.4.4.1 THE NUT WILL ROTATE FREELY IN ONLY ONE DIRECTION. DAMAGE WILL OCCUR TO THE PAWL IF NUT IS ROTATED AGAINST RESISTANCE.

C 2.4.5 INSERT THE LARGE CLEVIS PIN THROUGH THE CLEVIS AND ADJUSTER ARM WITH THE PINHEAD ON THE INBOARD (VEHICLE) SIDE OF THE ASA. INSERT THE LARGE PIN RETAINER CLIP.

C 2.4.6 USING TWO FINGERS, ALIGN THE HOLE IN THE ASA ACTUATOR ROD WITH THE HOLE IN THE CLEVIS. INSERT THE SMALL CLEVIS PIN THROUGH THE CLEVIS AND THE ACTUATOR ROD WITH THE PINHEAD ON THE INBOARD (VEHICLE) SIDE OF THE ASA. INSERT THE SMALL PIN RETAINER CLIP.

C 2.5 TIGHTEN THE JAM NUT AGAINST THE CLEVIS TO HOLD THE CLEVIS IN THE CORRECT POSITION.

2.5.1 USE A 15/16" OPEN END WRENCH ON THE JAM NUT.

2.5.2 TIGHTEN THE JAM NUT TO A TORQUE OF 20-30 LB-FT FOR 1/2"X20 THREADS (REF. 16" CHAMBERS) AND TO A TORQUE OF 25-50 LB-FT FOR 5/8"X18 THREADS (REF. 20" CHAMBERS).

C 2.6 ADJUST BRAKES.

2.6.1 WITH SPRING BRAKES (PARKING BRAKES) FULLY RELEASED, MINIMUM 90 PSI VEHICLE SYSTEM PRESSURE, RELEASE SPRING BRAKE CAGING TOOL.

2.6.2 TURN THE MANUAL ADJUSTING NUT IN THE DIRECTION OF LEAST RESISTANCE UNTIL THE BRAKE ASSEMBLY FREE STROKE IS 16-19MM (5/8-3/4 INCH). FREE STROKE IS NOT TO EXCEED 19MM (3/4 INCH). REFER TO FIGURE #D.

2.6.2.1 IF THE LINING CONTACTS THE DRUM.

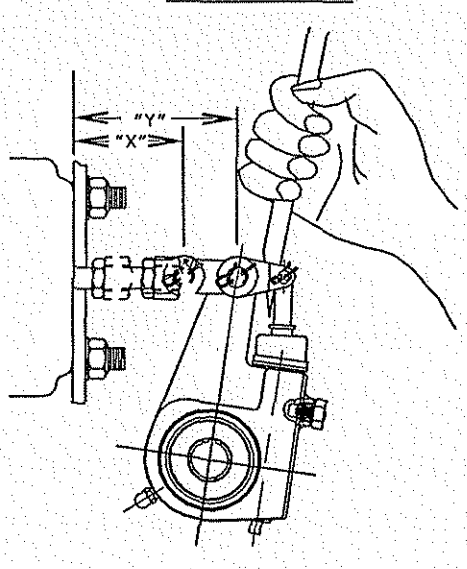
2.6.2.1.1 REMOVE THE PAWL ASSEMBLY FROM THE AUTOMATIC SLACK ADJUSTER.

2.6.2.1.2 TURN THE ADJUSTING NUT 1/2 TURN IN THE OPPOSITE DIRECTION.

2.6.2.1.3 REINSTALL THE PAWL ASSEMBLY.

2.6.2.1.4 TORQUE THE CAPSCREW TO 15-20 FT-LBS.

FIGURE D



"Y" MINUS "X" = FREE STROKE

MAXIMUM FREE STROKE 19MM (3/4 INCH).

Compiled	KNUDSON	SHOP PRACTICE BRAKE ADJUSTMENT	33-11119
Approved	KNUDSON		
Issued	3-29-76	FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised		Chg Ltr	

STOPMASTER (WEDGE) BRAKE ADJUSTMENT PROCEDURE

Although all wedge brakes which Freightliner uses are equipped with automatic adjusters, these brakes must be adjusted manually at time of installation.

The following procedure should be followed: Adjusting bolts have right hand threads. With an adjusting spoon, turn the star-wheel until a heavy drum drag is developed. Then back off the bolt to a very light drag on the drum (try two clicks of the star-wheel). Repeat for other shoe on the brake. Replace dust covers in adjusting slots. Repeat for other brakes.

NOTE: If the lining clearance with the drum is more than .060", they will not adjust automatically.

Compiled	LEVINGS	SHOP PRACTICE BRAKE ADJUSTMENT - CAM BRAKE	33-11122
Approved	QUTUB		
Issued	11-5-76		
Revised	2-18-83	Chg Ltr B **FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 1

B

Cam brakes are to be adjusted per the following procedures.

1. The cam brake adjustment should be checked by measuring the air chamber stroke with approximately 80 p.s.i. air pressure applied. The brake is to be adjusted to provied a minimum of running clearence between the brake shoes and the brake drum.

A

2. Brakes should always be adjusted if the stroke exceeds the maximum allowable stroke as listed in table A. (Distance A minus distance B equals the "stroke". See fig. 1.)

3. Adjust brakes by turning the adjusting screw on the slack adjuster, (See fig 1.) enough "clicks" to provide the necessary minimum of running clearence between the brake shoes and the drum. The best way to make This adjustment is to take-up on the adjusting screw untill it is tight and then back it off untill the drum is free. Normally it will require that the adjusting screw be backed off 2 or 3 "clicks".

Fig 1.

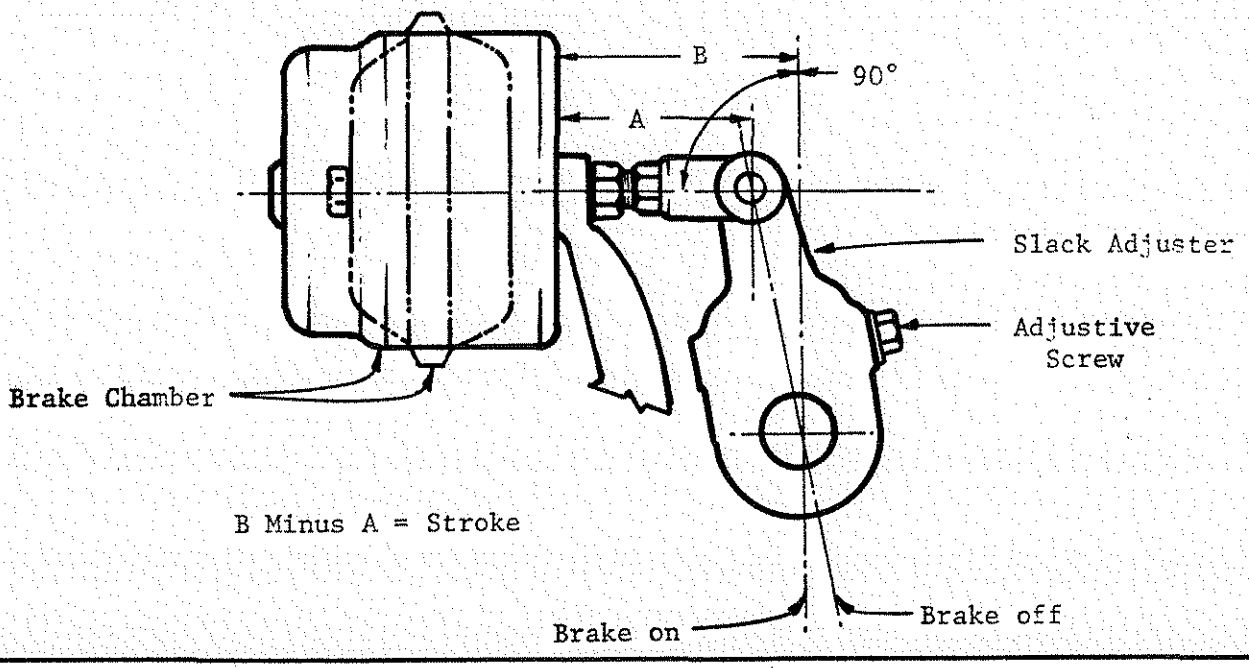


TABLE A

CHAMBER SIZE EFFECTIVE AREA (sq in)	MAXIMUM ALLOWABLE STROKE (in)
12	1 3/8
16	1 3/4
20	1 3/4
24	1 3/4
30	2
36	2 1/4

4. To determine that the brake is free from the drum strike the drum with a steel tool and listen for a clear "ring" sound. If a drag exist, that is, the brakes are expanded against the drum, a dull "thud" will be heard rather than the "ring", checking the brake adjustment with the wheel off of the ground is unreliable, loosness, or wear in the wheel bearings will cause the drum to be misaligned when the wheel is off the ground.

COMPILED	HADDOCK	SHOP PRACTICE INSTALLATION BRAKE REAR AXLE	SECTION NUMBER 33-11114
APPRV	DRS		PAGE 1 OF 1
ISSUE DATE	06/14/67	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
REV DATE	07/29/96		
CHG LTR	L		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-010 FOR BRAKE INSTALLATION REAR AXLE.

COMPILED	HADDOCK	SHOP PRACTICE CONTROLLED TRACTION DIFFERENTIAL SEASONAL ENGAGEMENT	SECTION NUMBER 33-11116
APPRV	D L R		
ISSUE DATE	09/18/72		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-011 FOR CONTROLLED TRACTION DIFFERENTIAL SEASONAL ENGAGEMENT PROCEDURE.

COMPILED	E R K	SHOP PRACTICE INSTALLATION OF ROCKWELL AUTOMATIC SLACK ADJUSTERS	SECTION NUMBER 33-11118
APPRV	J S B		PAGE 1 OF 1
ISSUE DATE	08/26/88	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
REV DATE	07/29/96		
CHG LTR	F		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-012 FOR INSTALLATION OF ROCKWELL AUTOMATIC SLACK ADJUSTERS.

COMPILED	ERK	SHOP PRACTICE INSTALLATION OF ROCKWELL AUTOMATIC SLACK ADJUSTERS	SECTION NUMBER 33-11118
APPRV	JSB		
ISSUE DATE	08/26/88		PAGE 1 OF 4
REV DATE	01/16/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2042-64

PURPOSE:

TO PROVIDE A PROCEDURE FOR THE INSTALLATION OF ROCKWELL AUTOMATIC SLACK ADJUSTERS AT TRUCK ASSEMBLY.

ABSTRACT:

THIS STANDARD DEFINES A DETAILED PROCEDURE FOR REAR AXLE INSTALLATION OF 5 1/2 INCH AND 6 INCH ROCKWELL AUTOMATIC SLACK ADJUSTERS (ASA'S) TO ROCKWELL OR EATON CAM BRAKE ASSEMBLIES.

D NOTE: ROCKWELL AUTOMATIC SLACK ADJUSTERS INSTALLED ON MGM LONG STROKE CHAMBERS, WITH WELDED CLEVIS, DO NOT REQUIRE CLEVIS ADJUSTMENT.

SCOPE:

THIS SHOP PRACTICE PRESCRIBES FREIGHTLINER'S REQUIREMENT FOR THE ASSEMBLY OF ROCKWELL AUTOMATIC SLACK ADJUSTERS TO EATON AND ROCKWELL CAM BRAKE ASSEMBLIES, INCLUDING PROCEDURES, THE INITIAL SETTINGS, AND OPERATING CONDITIONS. THE PRACTICE SHALL BE IN EFFECT IN THE ABSENCE OF SPECIFIC ENGINEERING DIRECTION.

RESPONSIBILITY:

ALL PERSONNEL RESPONSIBLE FOR THE INSTALLATION OF, OR THE ACCEPTANCE OF, ROCKWELL AUTOMATIC SLACK ADJUSTERS FITTED TO EATON OR ROCKWELL CAM BRAKE ASSEMBLIES SHALL BE RESPONSIBLE FOR ADHERENCE TO THIS PROCEDURE.

SPECIFICATION:

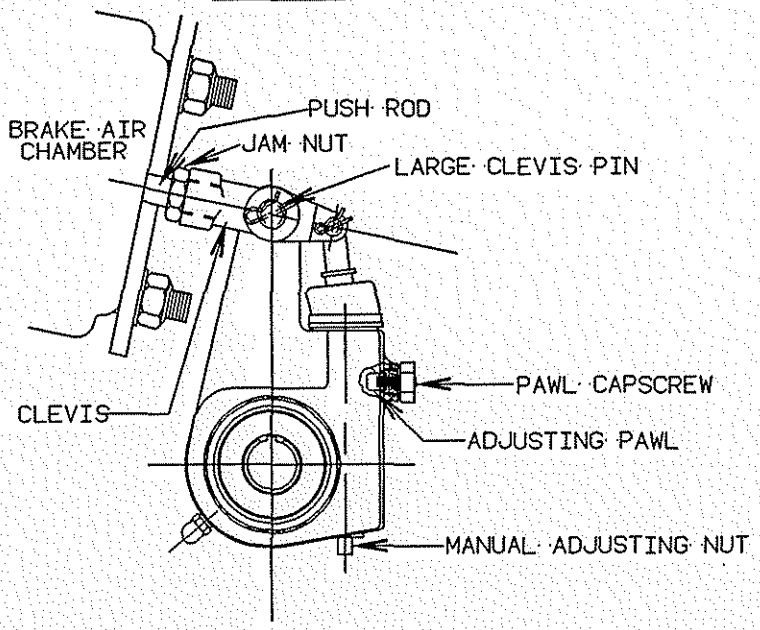
1. PRECAUTIONARY MEASURES

1.1 IT IS IMPERATIVE FOR SATISFACTORY OPERATION OF NOT ONLY THE ASA, BUT THE BRAKE ITSELF, THAT AFTER INSTALLATION THE SLACK ADJUSTER WILL OPERATE FROM FULL RELEASE POSITION (CHAMBER PUSH ROD FULLY RETRACTED) TO FULL AIR CHAMBER STROKE POSITION (CHAMBER PUSH ROD FULLY EXTENDED) WITHOUT ANY INTERFERENCE WITH ADJACENT CHASSIS COMPONENTS SUCH AS AXLE HOUSING OR SUSPENSION MEMBERS. SHOULD INTERFERENCE BE ENCOUNTERED, CORRECTIVE MEASURES TO ELIMINATE THE INTERFERENCE, APPROPRIATE TO THE SPECIFIC CIRCUMSTANCES, MUST BE TAKEN BEFORE THIS INSTALLATION CAN BE CONSIDERED COMPLETE. UNDER NO CIRCUMSTANCES SHALL THE SLACK ADJUSTER BE MODIFIED IN ANY WAY WHATSOEVER.

1.2 IF IT IS NECESSARY TO WELD IN THE AREA OF THE AUTOMATIC SLACK ADJUSTER, TAKE ADEQUATE PRECAUTIONS TO PROTECT THE RUBBER BOOT AGAINST WELD SPATTER.

1.3 THE MANUAL ADJUSTING NUT TURNS WITH MINIMAL RESISTANCE IN ONE DIRECTION ONLY. DO NOT FORCE IT AGAINST RESISTANCE ANYTIME DURING INSTALLATION OR ADJUSTMENT.

FIGURE A



2. INSTALLATION PROCEDURES:

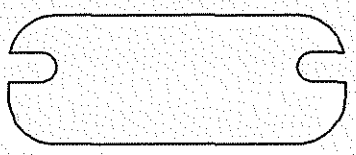
2.1 ASSEMBLE BRAKE CHAMBER TO BRAKE ASSEMBLY BRACKET MAKING CERTAIN IT IS PROPERLY POSITIONED.

2.1.1 DO NOT INSTALL ANY WASHERS BETWEEN CHAMBER AND BRACKET.

C 2.1.2 BRAKE CHAMBERS ARE TO BE IN A FULLY CAGED CONDITION WHEN RECEIVED FROM THE VENDOR.

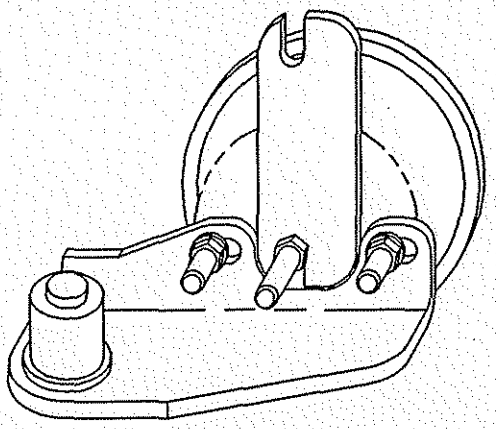
2.2 POSITION AND MAINTAIN THE ASA GAUGE (SHOWN IN FIGURE B) AGAINST THE FACE OF THE CHAMBER AND AROUND THE PUSH ROD. THREAD THE CLEVIS JAM NUT ON THE PUSH ROD UNTIL IT MAKES CONTACT WITH THE GAUGE (SEE FIGURE C). THREAD THE CLEVIS ON THE PUSH ROD AND FINGER TIGHTEN AGAINST THE JAM NUT.

FIGURE B



THICKNESS: .480" ± .065

FIGURE C



C 2.2.1 THE CLEVIS IS TO BE THREADED ON THE PUSH ROD WITH +1/8"/-1/4" OF FULL THREAD ENGAGEMENT AND ALIGNED TO ACCEPT THE SLACK ADJUSTER ARM

NOTE: PROCEED TO STEP 2.4.4 IF THE BRAKE ASSEMBLY IS RECEIVED WITH THE ASA FACTORY INSTALLED.

2.3 REMOVE SNAP RING, WASHERS, AND SPACER FROM CAMSHAFT.

2.4 INSTALL THE AUTOMATIC SLACK ADJUSTER ONTO THE CAMSHAFT SPLINE POSITIONING THE SLACK ADJUSTER SO THAT THE ADJUSTER ACTUATOR ROD IS ON THE SIDE AWAY FROM THE CHAMBER WITH THE SLACK ADJUSTER ARM JUST CLEARING THE CLEVIS.

2.4.1 ALWAYS INSTALL THE SLACK ADJUSTER SO THAT THE ADJUSTING PAWL CAPSCREW IS ACCESSIBLE, PERPENDICULAR TO THE AXLE OR FACING TOWARDS THE VEHICLE CENTERLINE.

2.4.2 INSTALL SPACING WASHERS, AS REQUIRED, ON THE CAMSHAFT TO POSITION THE SLACK ADJUSTER ON THE CAMSHAFT IN LINE WITH THE AIR CHAMBER PUSH ROD, WITH MAXIMUM END PLAY OF 1.6MM (.062") ALONG THE CAMSHAFT.

2.4.3 SECURE THE SLACK ADJUSTER TO THE CAMSHAFT BY INSTALLING SNAP RING.

C 2.4.4 ROTATE THE ASA ON THE CAMSHAFT BY TURNING THE MANUAL ADJUSTING NUT ON THE BOTTOM OF THE ASA UNTIL THE ADJUSTER ARM ROTATES INTO THE CLEVIS WITH THE LARGE HOLES IN THE ADJUSTER ARM AND THE CLEVIS ALIGNED.

2.4.4.1 THE NUT WILL ROTATE FREELY IN ONLY ONE DIRECTION. DAMAGE WILL OCCUR TO THE PAWL IF NUT IS ROTATED AGAINST RESISTANCE.

C 2.4.5 INSERT THE LARGE CLEVIS PIN THROUGH THE CLEVIS AND ADJUSTER ARM WITH THE PINHEAD ON THE INBOARD (VEHICLE) SIDE OF THE ASA. INSERT THE LARGE PIN RETAINER CLIP.

C 2.4.6 USING TWO FINGERS, ALIGN THE HOLE IN THE ASA ACTUATOR ROD WITH THE HOLE IN THE CLEVIS. INSERT THE SMALL CLEVIS PIN THROUGH THE CLEVIS AND THE ACTUATOR ROD WITH THE PINHEAD ON THE INBOARD (VEHICLE) SIDE OF THE ASA. INSERT THE SMALL PIN RETAINER CLIP.

C 2.5 TIGHTEN THE JAM NUT AGAINST THE CLEVIS TO HOLD THE CLEVIS IN THE CORRECT POSITION.

2.5.1 TIGHTEN THE JAM NUT TO A TORQUE OF 20-30 LB-FT FOR 1/2"X20 THREADS (REF. 16" CHAMBERS) AND TO A TORQUE OF 25-50 LB-FT FOR 5/8"X18 THREADS (REF. 20" CHAMBERS).

2.6 ADJUST BRAKES.

C 2.6.1 WITH SPRING BRAKES (PARKING BRAKES) FULLY RELEASED, MINIMUM 90 PSI VEHICLE SYSTEM PRESSURE, RELEASE SPRING BRAKE CAGING TOOL.

2.6.2 TURN THE MANUAL ADJUSTING NUT IN THE DIRECTION OF LEAST RESISTANCE UNTIL THE BRAKE ASSEMBLY FREE STROKE IS 13-16MM (.500-.625 INCH). FREE STROKE IS NOT TO EXCEED 16MM (.625 INCH). REFER TO FIGURE #D.

2.6.2.1 .00 INCH FREEPLAY IS ALLOWED AT AXLE BUILDUP WITH NEW COMPONENTS AS LONG AS THE BRAKE DRUM TURNS FREELY. SUBSEQUENT ADJUSTMENT MUST MAINTAIN .500 INCH MINIMUM FREEPLAY.

2.6.2.2 IF THE LINING CONTACTS THE DRUM.

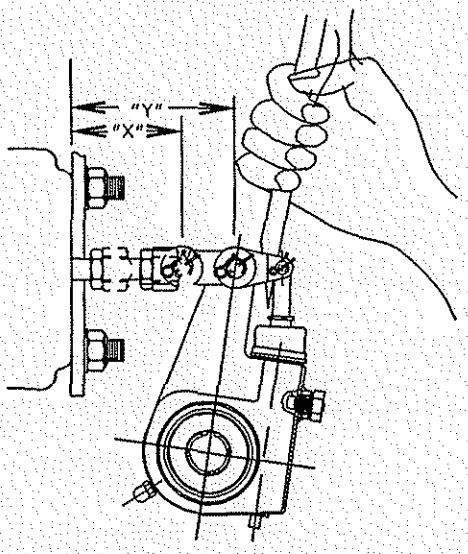
2.6.2.2.1 REMOVE THE PAWL ASSEMBLY FROM THE AUTOMATIC SLACK ADJUSTER.

2.6.2.2.2 TURN THE ADJUSTING NUT 1/2 TURN IN THE OPPOSITE DIRECTION.

2.6.2.2.3 REINSTALL THE PAWL ASSEMBLY.

2.6.2.2.4 TORQUE THE CAPSCREW TO 15-20 FT-LBS.

FIGURE D



"Y" MINUS "X" = FREE STROKE

MAXIMUM FREE STROKE 16MM (.625 INCH).

COMPILED	KNUDSON	SHOP PRACTICE BRAKE ADJUSTMENT	SECTION NUMBER 33-11119
APPRV	KNUDSON		
ISSUE DATE	03/29/76		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-013 FOR BRAKE ADJUSTMENT PROCEDURE.

COMPILED	LEVINGS	SHOP PRACTICE BRAKE ADJUSTMENT CAM BRAKE	SECTION NUMBER 33-11122
APPRV	QUTUB		PAGE 1 OF 1
ISSUE DATE	11/05/76	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
REV DATE	07/29/96		
CHG LTR	D		

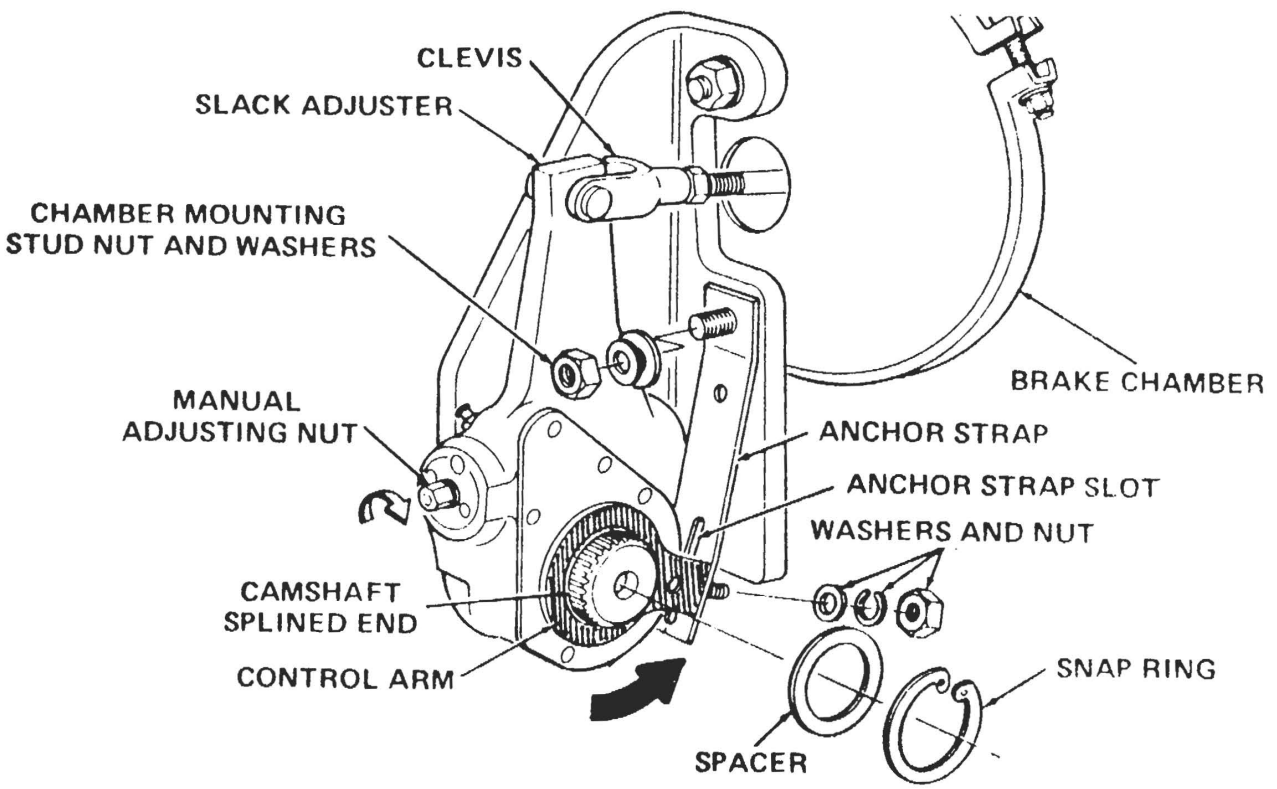
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-014 FOR CAM BRAKE ADJUSTMENT PROCEDURE.

COMPILED	D R S	SHOP PRACTICE AUTOMATIC SLACK ADJUSTER INSTALLATION, HALDEX	SECTION NUMBER 33-11123
APPRV	D R S		
ISSUE DATE	06/25/87		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-015 FOR AUTOMATIC SLACK ADJUSTER INSTALLATION PROCEDURE.

Compiled	D. Peeves HADDOCK	SHOP PRACTICE MANUAL AUTO SLACK INSTALLATION HALDEX	33-11123
Approved	DRS		
Issued	6-25-87		
Revised		Chg Ltr	FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

REAR AXLE UNIT W/STUDDED CONTROL ARM



1. Loosely attach anchor strap by installing strap to chamber mounting stud DO NOT TIGHTEN AT THIS TIME.

2. With manual adjusting nut pointing away from brake chamber, assemble slack adjuster onto camshaft splined end so that the lever arm clears the clevis on the air chamber push rod. Use camshaft spacing washers to align slack adjuster with centerline of air chamber. Secure slack adjuster on the camshaft by assembling spacing washers and snap ring.

3. Using a 7/16" wrench, turn the manual adjusting nut clockwise to move the slack adjuster toward the clevis and at the same time assist the control arm stud to enter the anchor strap slot by slightly bending the strap to clear the stud and aligning the slot with the stud. When the stud is in the strap slot, continue to turn adjusting nut until the clevis pin holes in the slack adjuster and clevis are perfectly aligned. Install clevis pin and secure with a cotter pin.

CAUTION

All Freightliner cam brakes both front & rear are to use the 5.50 slack adjuster length.

4. Position control arm in its full released position by forcing it in direction of arrow "A" (toward brake chamber) until it comes to a positive stop (inside slack adjuster). Do not hammer on control arm.

5. Install 5/16 flat washer, lockwasher and 5/16 - 18 nut on control arm stud loosely. Do not tighten nut.

6. Tighten nut at chamber bracket end of strap.

7. Securely hold control arm in its full released position (in direction of arrow "A"). Tighten 5/16 - 18 nut on control arm stud to 10-15 LB-FT.

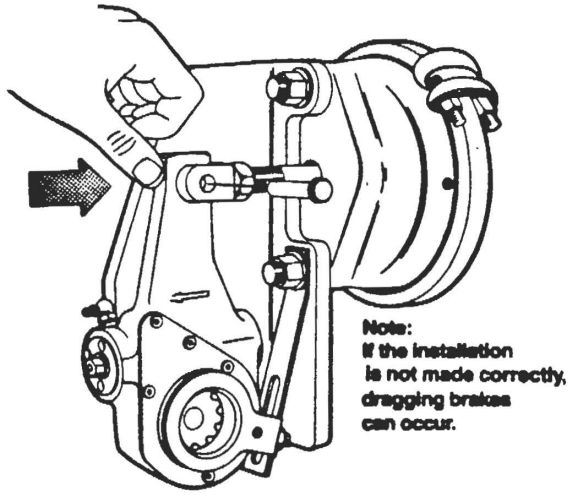
8. Adjust the brake lining clearance by turning the adjustment hex nut clockwise until the brake lining meets the brake drum, then back off counter clockwise 3/4 of a turn. (A ratcheting sound can occur).

9. Final Check - Control location.

   IMPORTANT - Check installation by removing clevis pin. Push the slack adjuster into the clevis. If the slack adjuster hole and clevis pin hole remain in alignment on release, the installation is properly made. Secure all fasteners.

   If the slack adjuster hole is not aligned with the clevis pin hole, replace the clevis pin. Loosen the control arm fasteners and move the control arm towards the brake chamber until it comes to a definite stop. Tighten the bracket fasteners. Repeat the final check.

   Correctly adjusted slack adjusters will allow free running clearance to drum.



COMPILED	HADDOCK	SHOP PRACTICE	SECTION NUMBER
APPRV	D R S	DUSTSHIELD INSTALLATION	33-11124
ISSUE DATE	01/26/83		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	A		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-016 FOR DUSTSHIELD INSTALLATION PROCEDURE.

Compiled	HADDOCK	SHOP PRACTICE DUSTSHIELD INSTALLATION	33-11124
Approved	DRS		
Issued	1-26-83		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

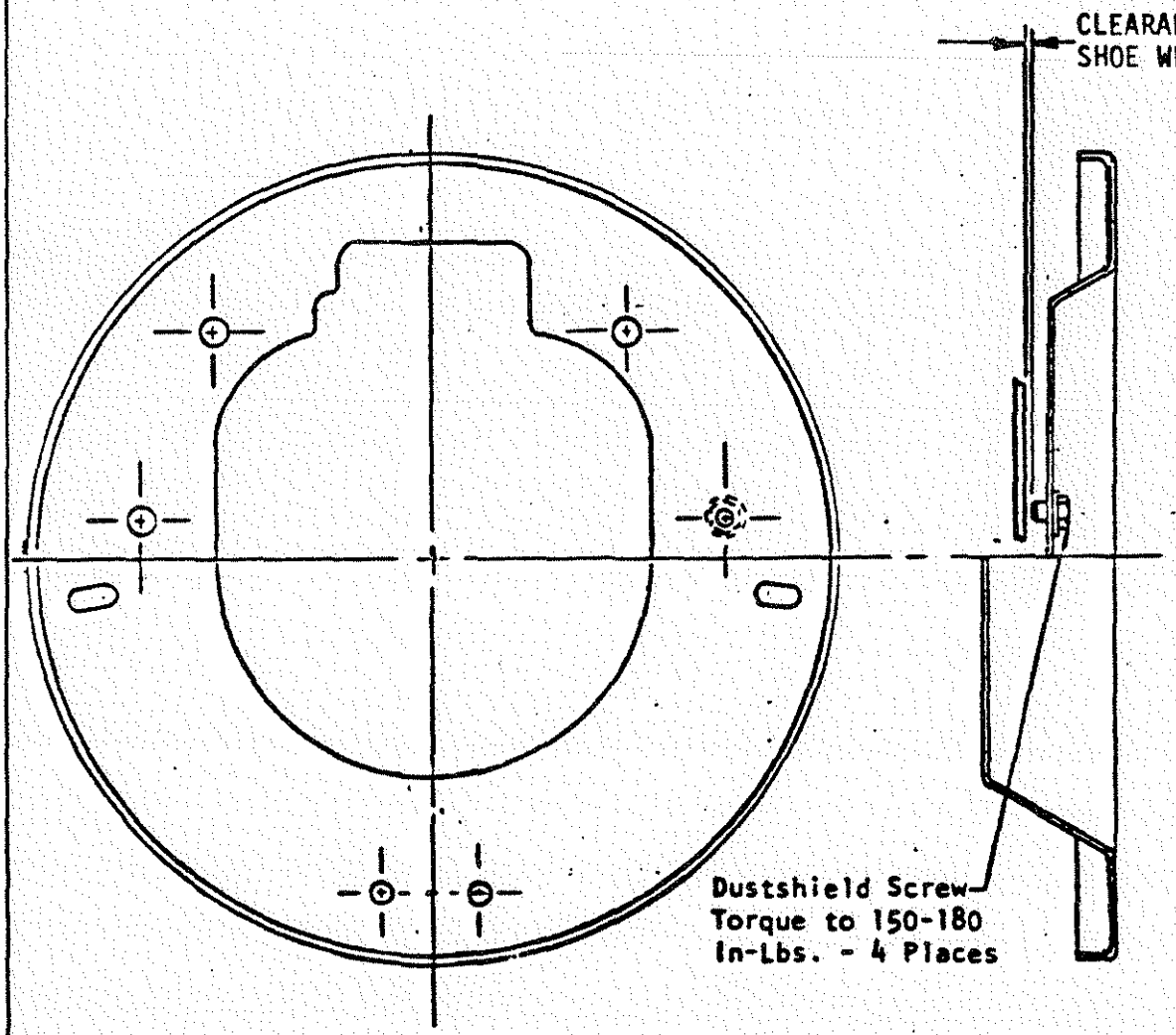
A. EATON - ESA541LW REAR CAM BRAKES, ONE PIECE DUSTSHIELD

1. Position the dustshield assembly on the brake spider.

2. Fasten dustshield to brake spider with screws specified and torque to 150 to 180 in-lbs.

CAUTION

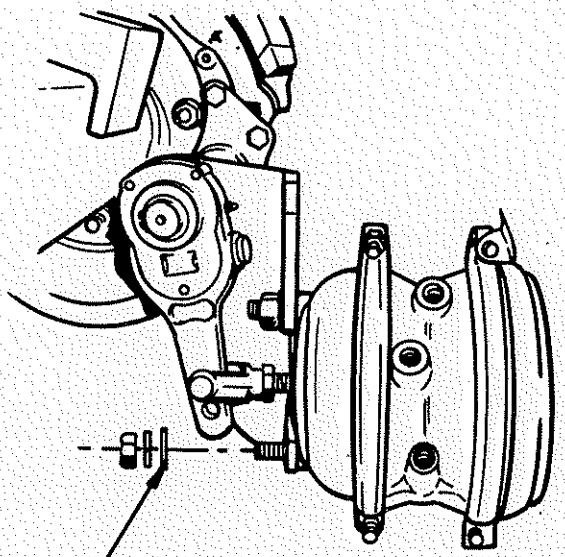
Maximum length (extending below washer) of screw must not exceed .506 to prevent interference with shoe web.



COMPILED	F H	SHOP PRACTICE BRAKE CHAMBER INST, RR	SECTION NUMBER 33-11125
APPRV	FRE S		PAGE 1 OF 1
ISSUE DATE	01/06/86	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
REV DATE	07/29/96		
CHG LTR	B		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-017 FOR REAR BRAKE CHAMBER INSTALLATION PROCEDURE.

Compiled	D. WELKER	SHOP PRACTICE BRAKE CHAMBER INSTALLATION REAR	33-11125
Approved	D.C.R.		
Issued	1-6-86		
Revised		Chg Ltr **FREIGHTLINER CORPORATION** PORTLAND, OREGON	



REAR

A HARDENED FLATWASHER IS TO BE INSTALLED BETWEEN THE LOCKWASHER OR LOCKNUT AND THE BRAKE CHAMBER BRACKET.

COMPILED	E R K	SHOP PRACTICE NUT TIGHTENING SEQUENCE AXLE SHAFT FLANGE	SECTION NUMBER 33-11126
APPRV	J S B		PAGE 1 OF 1
ISSUE DATE	11/24/93	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
REV DATE	07/29/96		
CHG LTR	A		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0011-018 FOR AXLE SHAFT FLANGE NUT TIGHTENING PROCEDURE.

COMPILED	DCW	SHOP PRACTICE INSTALLATION HUB/DRUM ASSEMBLY TO FRONT AND REAR AXLE	SECTION NUMBER 33-11127
APPRV	IJW		
ISSUE DATE	09/19/94		PAGE 1 OF 1
REV DATE	06/12/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-70

PURPOSE

INSURE THAT THE HUB AND DRUM ARE PROPERLY INSTALLED TO THE SPINDLE WITHOUT DAMAGE TO THE FRONT AND REAR AXLE.

PROCEDURE

1.1 INSTALL THE INNER BEARING AND SEAL ACCORDING TO THE APPROPRIATE SHOP PRACTICE.

1.2 FROM THE STAGING CONVEYOR, STOCK THE HUB AND DRUM ASSSEMBY TO THE AXLE USING OVERHEADLIFT WITH APPROPRIATE LIFTING ATTACHMENT.

1.3 MAKE SURE THAT THE SPINDLE THREAD PROTECTOR (BULLET) IS IN PLACE. POSITION THE HUB AND DRUM ONTO THE SPINDLE AND FIRMLY BUT GENTLY PUSH THE ASSEMBLY ALL THE WAY INTO POSITION. CARE MUST BE USED DURING INSTALLATION TO KEEP THE HUB CENTERED ON THE SPINDLE TO PREVENT DAMAGE TO THE SEAL OR THE BEARING.

1.4 ONCE THE HUB IS PROPERLY SEATED AND WITH THE LIFT SYSTEM STILL SUPPORTING THE HUB, REMOVE THE "BULLET" AND INSTALL THE OUTER BEARING CONE ON THE SPINDLE AND TO THE HUB.

1.5 SECURE THE BEARING IN PLACE BY POSITIONING AND HAND TIGHTENING THE OUTER BEARING ADJUSTMENT NUT AGAINST THE BEARING.

1.6 REPEAT OPERATIONS 1.2 THROUGH 1.6 AS REQUIRED. FINISH THE INSTALLATION OF THE HUB AND DRUM ASSEMBLY TO THE AXLE AS PER THE FRONT AND REAR WHEEL BEARING ADJUSTMENT SHOP PRACTICES.

Approved	DJL	SHOP PRACTICE BRAKE CONTROL, CONTENTS	33-12100
Issued	11/04/68		
Revised	07/21/88	Chg Ltr V FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-38

PRACTICE NO.	DESCRIPTION
33-12101	ROUTING OF FLEXIBLE LINES 1. Choice of Hose 2. Avoiding Heat Sources 3. Avoiding Hazards 4. Installation Sequence 5. Hose Length 6. Flexing 7. Pivot Points 8. Clamps 9. Installation Planning 10. Simplification
33-12102	AIR RESERVOIR VALVE EXHAUST
33-12103	AIR RESERVOIR, SYSTEM LEAKAGE
33-12104	COMPRESSOR DISCHARGE LINE
33-12105	SUBSTITUTION OF FITTINGS
33-12106	ASSEMBLING FLEXIBLE HOSES
33-12107	AIR RESERVOIR, GOVERNOR
33-12108	NYLON TUBING COLOR CODING, CANADA UNITS
33-12109	TRACTOR/TRAILER AIR BRAKE TEST
33-12111	TUBING/PIPING CONNECTORS, TIGHTENING
33-12112	BRAKE LINE, ROUTING
33-12113	SAFETY VALVE ORIENTATION
33-12114	AIR TANK MOUNTING TO FRAME RAIL
33-12115	EJECTOR VALVE PLUMBING
33-12130	BRAKE SYSTEMS FMVSS #121

COMPILED	LOUTZENHISER
APPRV	DJL
ISSUE DATE	11/11/85
REV DATE	07/05/94
CHG LTR	C

SHOP PRACTICE

FLEXIBLE LINES ROUTING

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-12101
PAGE 1 OF 7
PA2042-46

1. CHOICE OF HOSE FOR NON-AIR BRAKE USE

1.1 METAL OR HOSE?

1.1.1 IF ONE COMPONENT OF A HYDRAULIC SYSTEM MUST MOVE IN RELATION TO THE OTHER COMPONENTS, FLEXIBLE HOSE IS OFTEN THE BEST CHOICE FOR THE FLUID LINES. FLEXIBLE HOSE MAY ALSO BE THE MOST PRACTICAL SOLUTION IF SYSTEM VIBRATION IS SEVERE.

1.2 LOW PRESSURE

1.2.1 LOW PRESSURE HOSE (NOT WIRE BRAIDED) CAN BE USED IF REQUESTED ONLY FOR CERTAIN APPLICATIONS INSIDE THE CAB. THESE ARE LIMITED TO LINES UNDER THE INSTRUMENT PANEL AND THE AIR VALVE BOX AND RUNNING TO NEARBY JUNCTION BLOCKS OR FITTINGS. THEY ARE NOT TO BE USED IN EXPOSED AREAS NOR ARE THEY TO BE RUN THROUGH BULKHEADS OR CHANNELS WHICH MAY HAVE SHEET METAL SCREWS PROJECTING INTO THEM.

1.3 MEDIUM PRESSURE

1.3.1 MEDIUM PRESSURE WIRE BRAIDED HOSE CAN BE USED IF REQUESTED FOR ALL APPLICATIONS OUTSIDE THE CAB INTERIOR, INCLUDING LINES IN THE ENGINE COMPARTMENT.

1.3.2 EXCEPTIONS: A. LINES WHICH MUST WITHSTAND MUCH FLEXING AND WEAR (SEE 1.4)
B. COMPRESSOR DISCHARGE LINE (REF 33-12104).

1.4 SPECIAL HIGH FLEX HOSE

1.4.1 SPECIAL HIGH FLEX HOSES SUCH AS B-W 101-M OR 304-M ARE USED BETWEEN THE RELAY VALVE AND THE AXLE BRAKE CHAMBERS.

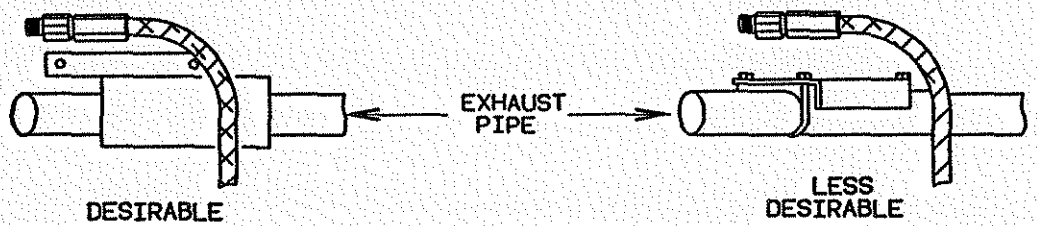
NOTE: THESE ARE TO BE USED FOR CANADA BUILT UNITS ONLY, DOES NOT COMPLY WITH FMVSS #121.

2. AVOIDING HEAT

2.1 EXCESSIVE HEAT WILL RAPIDLY DETERIORATE THE MATERIAL IN THE HOSES. HOSES SHOULD BE ROUTED AROUND SOURCES OF INTENSE HEAT SUCH AS ENGINE EXHAUST SYSTEMS. AT LEAST SIX INCHES OF CLEARANCE SHOULD BE PROVIDED. MORE CLEARANCE IS BETTER, ESPECIALLY IF LOCATED ABOVE THE HEAT SOURCE.

WHEN THE HEAT IS INTERNAL, AS IN THE CASE OF COMPRESSOR DISCHARGE LINE, SPECIAL HEAT RESISTANT MATERIAL MUST BE USED FOR THE JOB.

IF THE LINE CANNOT BE ROUTED MORE THAN SIX INCHES AWAY FROM THE HEAT SOURCE, A SHEET METAL SHIELD SHOULD BE PROVIDED BETWEEN THE TWO TO CUT DOWN THE HEAT RADIATION. AN AIR SPACE MUST BE PROVIDED ON BOTH SIDES OF THE SHIELD TO ALLOW THE HEAT TO DISSIPATE. THE SHIELD MUST BE LONG ENOUGH TO PROVIDE PROTECTION ALONG THE ENTIRE LENGTH OF EXPOSURE. THE SHIELD SHOULD BE ATTACHED TO A "COLD" PART, RATHER THAN TO A HEAT SOURCE, IF POSSIBLE. (SEE FIGURE 1)



- SHIELD ATTACHED TO "COLD" SURFACE
- HAS AIR GAP
- COVERS AREA OF EXPOSURE

- SHIELD ATTACHED TO "HOT" PART
- HAS NO AIR GAP
- DOES NOT COVER AREA OF EXPOSURE

FIGURE 1

3. AVOIDING OTHER HAZARDS

3.1 FLEXIBLE LINES MUST BE ROUTED AND SUPPORTED SO THAT THE FOLLOWING HAZARDS ARE MINIMIZED.

3.1.1 EXPOSURE TO ICE

3.1.1.1 WHERE WHEEL SPLASH IS UNAVOIDABLE, CLAMP LINES TO STRUCTURAL PARTS AND AVOID LONG, EXPOSED LOOPS.

3.1.2 EXPOSURE TO HUMAN TRAFFIC

3.1.2.1 LINES SHOULD NOT BE LOCATED ON TOP OF ANYTHING LIKELY TO BE STEPPED OR WALKED UPON. LINES SHOULD BE ROUTED TO AVOID INTERFERING WITH ROUTINE MAINTENANCE SUCH AS FLUID CHECKS AND FILLS AND FILTER REPLACEMENT. LINES SHOULD ALSO BE ROUTED TO AVOID EXPOSURE TO CHEMICAL CONTAMINATION (OIL, FUEL, ETC.) OF LINES AND MAINTENANCE PERSONNEL DURING SERVICING.

3.1.3 EXPOSURE TO MOVING PARTS

3.1.3.1 CONSIDER CAREFULLY THE MANNER OF OPERATION OF THE TRUCK SO THAT SUCH THINGS AS DRIVELINES, TRAILER BODIES, KINGPINS, AND AXLES WILL NOT CATCH OR PINCH THE LINES.

4. INSTALLATION SEQUENCE

4.1 INSTALL THE LARGEST, INSTEAD OF THE EASIEST, LINES FIRST. THUS, THE MOST DIFFICULT PART OF THE INSTALLATION IS OUT OF THE WAY. LARGER LINES REQUIRE MORE SPACE BECAUSE OF THEIR LIMITED BEND RADIUS. THE BEND RADIUS OF SMALLER LINES PERMITS MORE FREEDOM OF CHOICE IN THEIR ROUTING. EACH LINE SHOULD BE ARRANGED TO CONSERVE SPACE, CONSISTENT WITH NEATNESS OF INSTALLATION AND PROVISIONS FOR FUTURE MODIFICATION OF ADDITION OF ACCESSORIES.

5. HOSE LENGTH

5.1 EXCESSIVE HOSE LENGTH INCREASES COST, SUBJECTS THE HOSE TO ENVIROMENTAL HAZARDS, AND DETRACTS FROM APPEARANCE. THE HOSE MUST BE LONG ENOUGH TO PROVIDE FOR AT LEAST THE MINIMUM RADIUS FOR ALL BENDS. WHERE EITHER END IS ATTACHED TO A MOVING PART, THE HOSE LENGTH MUST ADEQUATELY PROVIDE FOR THE ENTIRE RANGE OF RELATIVE MOTION.

6. FLEXING

6.1 A HOSE IS DESIGNED TO FLEX OR BEND. IT IS NOT DESIGNED TO BE TORQUED OR TWISTED. A SEVEN (7) DEGREE TWIST IN A LARGE DIAMETER, FLEXING, HIGH-PRESSURE HOSE LINE CAN REDUCE SERVICE LIFE AS MUCH AS NINETY (90) PER CENT.

7. PIVOT POINTS

7.1 IN A FLEXING APPLICATION, ROUTING THE HOSE THROUGH THE PIVOT POINT AROUND WHICH THE COMPONENT MOVES HAS CERTAIN ADVANTAGES. THIS PRACTICE HELPS INCREASE FLEXING EFFICIENCY, USES THE LEAST AMOUNT OF HOSE, AND KEEPS THE HOSE WITHIN THE PROFILE OF THE VEHICLE. (SEE FIGURE 2)

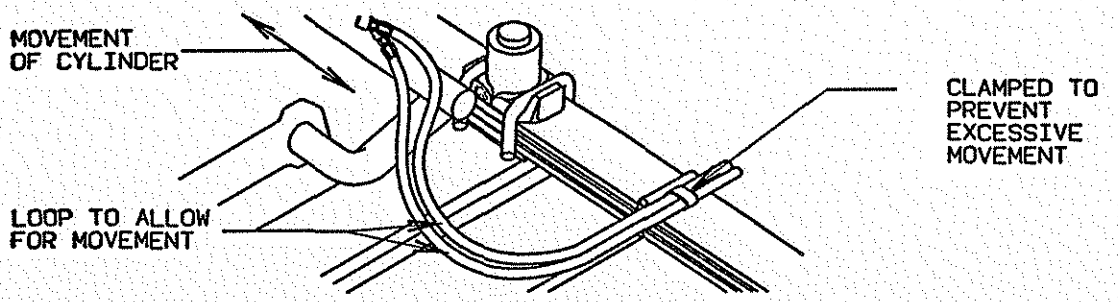


FIGURE 2

7.2 THE HOSE LINE SHOULD BE POSITIONED SO THAT THE BEND WILL OPEN AND CLOSE LIKE A HINGE. IF THE HOSE DOES NOT FLEX IN THIS MANNER, IT MAY HAVE TO TAKE AN S-BEND DURING THE MOVEMENT CYCLE, ESPECIALLY WHEN THE HOSE IS BEING PUSHED RATHER THAN BENT. THIS S-BEND TYPE OF INSTALLATION PRODUCES EXCESSIVE HOSE MOVEMENT AND SHORTENS SERVICE LIFE.

8. CLAMPS

8.1 DO NOT CLAMP TOGETHER PARALLEL HIGH PRESSURE LINES.

8.1.1 THE DIFFERENCE IN THE LENGTH CHANGE OF THE TWO LINES UNDER PRESSURE PRODUCES A SEESAW ACTION BETWEEN THE TWO CLAMPS.

8.2 DO NOT ROUTE AND/OR CLAMP FUEL LINES AND BATTERY CABLES TOGETHER.

8.3 CLAMPS SHOULD BE AT LEAST .0313 INCH (1/32") SMALLER THAN THE OD OF THE HOSE. THIS FIT WILL AVOID ABRASION OF THE HOSE BY THE CLAMP.

8.4 FLUID CONDUCTORS MUST BE ADEQUATELY CLAMPED FOR SATISFACTORY SERVICE. REGULAR HOSE AND TUBING CLAMPS WILL NOT HOLD A LARGE, HIGH PRESSURE HOSE. THE CLAMP SHOWN IN FIGURE 2 PIVOT POINTS, IS INEXPENSIVE AND EFFECTIVE FOR HIGH PRESSURE SURGING LINES. IN ROUTING, LONG HOSE LINE LENGTHS SHOULD BE PLANNED TO PERMIT PROPER CLAMPING. CHANGE IN LENGTH OF THE HOSE AS A RESULT OF PRESSURE SURGES SHOULD BE ANTICIPATED WHEN LINES ARE CLAMPED. PROPER ROUTING AND CLAMPING CAN PREVENT ABRASION.

8.5 ALTHOUGH LINES SHOULD NOT BE CROSSED, IT IS SOMETIMES UNAVOIDABLE. IF CROSSED, THE TWO HOSE LINES SHOULD BE CLAMPED TOGETHER AT THE JUNCTION POINT.

8.6 FRAME TO AXLE AIR BRAKE LINES

8.6.1 BECAUSE OF AXLE ARTICULATION AND RESULTING HOSE MOVEMENT:

DO NOT TIE WRAP AXLE ROUTED AIR LINES TO EACH OTHER.

USE INDIVIDUAL CUSHIONED HOSE CLAMPS FOR EACH AIR LINE THAT IS ROUTED TO ANY AXLE (FRONT OR REAR).

8.6.2 CARE MUST BE TAKEN THAT ANY HOSE CLAMPING DOES NOT RESULT IN PINCHED OR KINKED HOSES IN ALL ANTICIPATED HOSE POSITIONS.

9. PLANNING THE INSTALLATION OF LINES

9.1 POSITION OF HYDRAULIC COMPONENTS ON THE VEHICLE IS AN IMPORTANT FACTOR IN THE SUCCESS OF A FLUID-CONDUCTOR INSTALLATION. FOR THE MOST SUCCESSFUL INSTALLATION, LINES SHOULD BE ROUTED IN A PARALLEL PATTERN. THEY SHOULD BE ROUTED TO FOLLOW THE CONTOUR OF THE FRAMEWORK OF THE VEHICLE, AND KEPT WITHIN THE ENVELOPE DIMENSIONS. CROSSING LINES SHOULD BE AVOIDED WHERE POSSIBLE.

9.2 SMOOTH ROUTING OF CONDUCTORS IN PARALLEL PATTERNS CAN BE ACCOMPLISHED BY USE OF CLAMPS, MANIFOLDS, AND ADAPTERS WHERE NECESSARY. PORT POSITIONS ON THE COMPONENTS SHOULD BE ARRANGED TO KEEP LINES PARALLEL. POSITION OF PUMPS, CYLINDERS AND HYDRAULIC MOTORS ARE USUALLY FIXED BY THEIR RELATIONSHIP TO OTHER COMPONENTS. HOWEVER, MOST CYLINDERS CAN BE ROTATED 180 DEGREES. THIS SLIGHT CHANGE MAY SOLVE MANY PROBLEMS. PORTS ON PUMPS AND HYDRAULIC MOTORS CAN USUALLY BE ROTATED IN INCREMENTS OF 90 DEGREES. INTAKE AND PRESSURE PORTS OF SOME PUMPS CAN BE ROTATED IN RELATION TO EACH OTHER TO IMPROVE ROUTING.

9.3 PARALLEL ROUTING CAN:

A. DECREASE COST OF A SYSTEM BY REDUCING LINE LENGTHS AND THE NUMBER OF ANGULAR ADAPTERS.

B. INCREASE EFFICIENCY BY REDUCING THE NUMBER OF SHARP BENDS.

C. INCREASE SERVICEABILITY BY PROTECTING LINES FROM ENVIRONMENTAL HAZARDS.

D. IMPROVE APPEARANCE OF THE VEHICLE.

9.4 POSITION OF THE COMPONENTS IN RELATION TO EACH OTHER SHOULD ALSO BE CONSIDERED. COMPONENTS SHOULD BE LOCATED FAR ENOUGH APART TO PROVIDE SUFFICIENT SPACE FOR INSTALLATION OF ADAPTERS AND FITTINGS ON THE CONNECTING HOSE OR TUBING. IF SHORT LINES ARE REQUIRED, THE PORTS ON CONNECTING COMPONENTS SHOULD BE OFFSET IN RELATION TO EACH OTHER. A SHORT HOSE OR PIECE OF TUBING IS VERY DIFFICULT TO INSTALL IN DIRECTLY OPPOSED PORTS. IN SOME NON-AIR BRAKE USAGE CASES, COILS OF TUBING AND LOOPS OF HOSE CAN BE USED TO CONNECT PORTS THAT ARE TOO CLOSE TOGETHER.

CAREFUL POSITIONING OF COMPONENTS IN A SYSTEM CAN OFTEN MAKE THE SYSTEM MORE SERVICEABLE AND REDUCE THE MATERIAL REQUIRED. IF CONDUCTORS ARE NOT CONSIDERED DURING THE LOCATION OF THE COMPONENTS, THEY MAY BE DIFFICULT TO INSTALL, AND CAUSE FUNCTION PROBLEMS IN THE SYSTEM.

NOTE: DO NOT RELOCATE FMVSS #121 COMPONENTS WITHOUT WRITTEN PRODUCT ENGINEERING APPROVAL.

9.5 SERVICE CONSIDERATIONS

9.5.1 ALL FLEXIBLE LINES MUST BE ROUTED SO THAT ROUTINELY SERVICEABLE COMPONENTS (I.E., FUEL FILTERS, FUEL WATER SEPARATORS, OIL FILTERS, AIR CLEANERS, DIP STICKS, BELT DRIVES) CAN BE READILY ACCESSED FOR ADJUSTMENT OR ELEMENT REMOVAL WITHOUT THE NEED TO RELOCATE OR REMOVE ANY LINES.

10. SIMPLIFY PIPING AND FITTINGS AS MUCH AS POSSIBLE.

10.1 KEEP PIPING AS STRAIGHT AS POSSIBLE, USING LARGE RADIUS BENDS INSTEAD OF SHARP ONES. USE 45 DEGREE IN PLACE OF 90 DEGREE ELBOWS WHEN POSSIBLE; ALSO, USE STRAIGHT FITTINGS IN PLACE OF ELBOWS OR ANGLE FITTINGS WHENEVER REASONABLE.

10. SIMPLIFY PIPING AND FITTINGS AS MUCH AS POSSIBLE (CONTINUED)

10.2 ROUTING INTER-TANK AIR LINES

10.2.1 ROUTE INTER-TANK AIR LINES AS DIRECTLY AS POSSIBLE FROM WET (SUPPLY TANK) TO CHECK VALVE ON PRIMARY AND SECONDARY TANK. DO NOT ROUTE VIA CROSSMEMBER EXCEPT TO AVOID KING PIN INTERFERENCE. (SEE FIGURE 3) NO ELBOWS NOR OTHER FITTINGS MUST BE CONNECTED BETWEEN TANK AND CHECK VALVE.

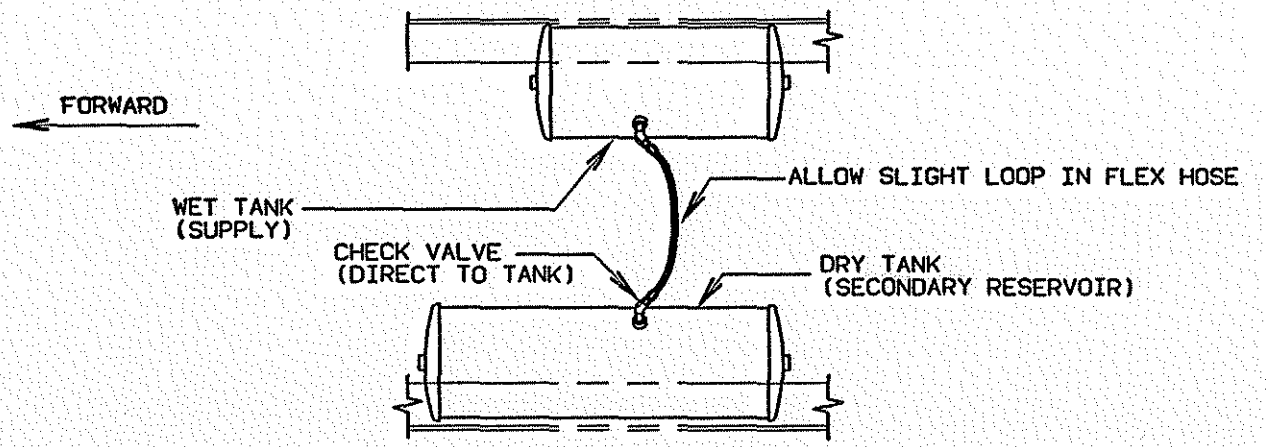


FIGURE 3

10.3 AIR LINE CONNECTIONS

C **10.3.1** CONNECTING AIR LINES FROM THE SEVERAL DASH-MOUNTED AIR VALVES TO THE ANCHOR COUPLINGS PASSING THROUGH THE FIREWALL/DECK IS MUCH SIMPLIFIED BY BRINGING THE HOSES IN A BROAD SWEEP AROUND THE VALVE CLUSTER, STARTING AT THE VALVES IN A DIRECTION AWAY FROM THE COUPLING TO BE REACHED (SEE FIGURE 4). THIS ADDS A SMALL AMOUNT OF EXTRA TUBING BUT MAKES EACH LINE LONG ENOUGH TO BE INSTALLED EASILY EVEN WITH ALL THE OTHERS IN PLACE. IN ROUTING MANY LINES IN RESTRICTED SPACE, IT IS WELL TO REMEMBER THAT "THE LONGEST WAY AROUND IS OFTEN THE SHORTEST WAY HOME".

C

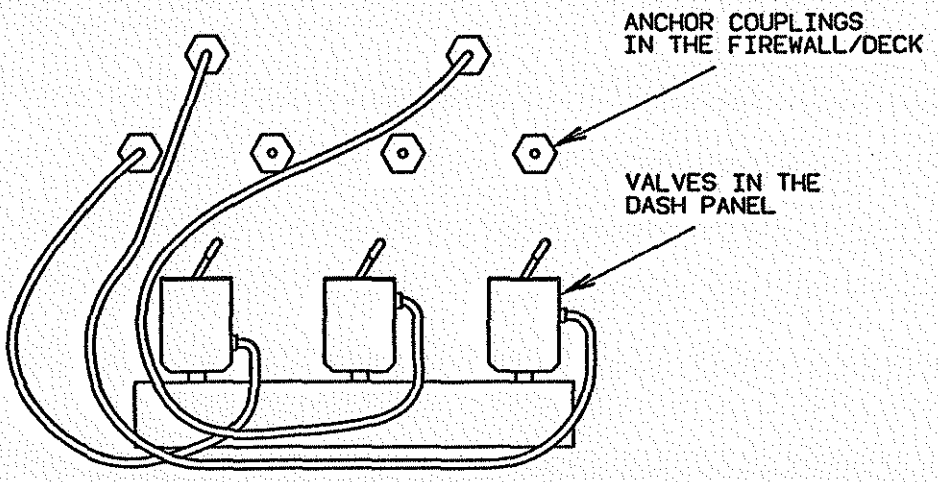
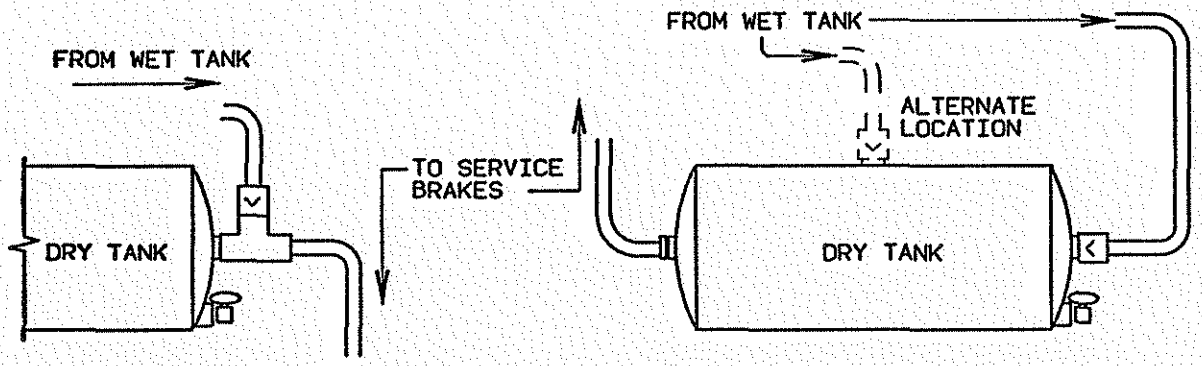


FIGURE 4

10. SIMPLIFY PIPING AND FITTINGS AS MUCH AS POSSIBLE(CONTINUED)

10.4 CHECK VALVE LOCATION (CANADA BUILT UNITS ONLY-DOES NOT COMPLY WITH FMVSS #121)

10.4.1 THE INTER-TANK CHECK VALVE MUST BE ADJACENT TO THE DRY AIR TANK WITH NO COMPLEX OF FITTINGS ATTACHED DIRECTLY TO IT (SEE FIGURE 5). ALSO, THE SERVICE LINE TO THE BRAKES SHOULD LEAVE AT THE OPPOSITE END OF THE TANK FROM THE LINE FROM THE WET AIR-TANK, OR FROM THE TOP PORT, IF NECESSARY.



LINE FROM WET TANK AND SERVICE LINE ON SAME FITTING

WRONG

LINE FROM WET TANK AND SERVICE LINE ON SEPARATE PORTS

RIGHT

FIGURE 5

10.5 CONNECT TRAILER AIR LINES DIRECTLY TO THE TRACTOR PROPECTION VALVE. PIPE BY WAY OF ANCHOR COUPLINGS IN BRACKETS ONLY WHEN DIRECT CONNECTION IS NOT PRACTICAL.

10.6 SLEEPER BOX MOUNTS

10.6.1 CARE MUST BE TAKEN IN THE FORWARD SLEEPER BOX MOUNT AREA TO ROUTE THE LINES CLOSE TO THE BOTTOM FRAME RAIL FLANGE. THE MOUNT BOLT MUST BE INSERTED FROM UNDER THE FLANGE AND INSUFFICIENT CLEARANCE MAKES THE INSTALLATION DIFFICULT.

10. SIMPLIFY PIPING AND FITTINGS AS MUCH AS POSSIBLE (CONTINUED)

10.7 SHIFT LINKAGE

10.7.1 ROUTE SHIFT AIR LINES BELOW THE SHIFT LINKAGE AS SHOWN WITH BREAK OUT OF THE RAIL ROUTING AT SEVEN (7) INCHES AFT OF THE ENGINE MOUNT.

NOTE: ALL LINES MUST BE CUT TO LENGTH AND STRAPPED TOGETHER TO PREVENT ENTANGLEMENT WITH THE SHIFT LINKAGE (SEE FIGURE 6).

10.7.2 THE AIR COMPRESSOR DISCHARGE LINE SHOULD BE ROUTED OVER THE TRANSMISSION ATTACHED WITH STANDOFF BRACKETS AT THE FORWARD CORNER TRANSMISSION BOLTS.

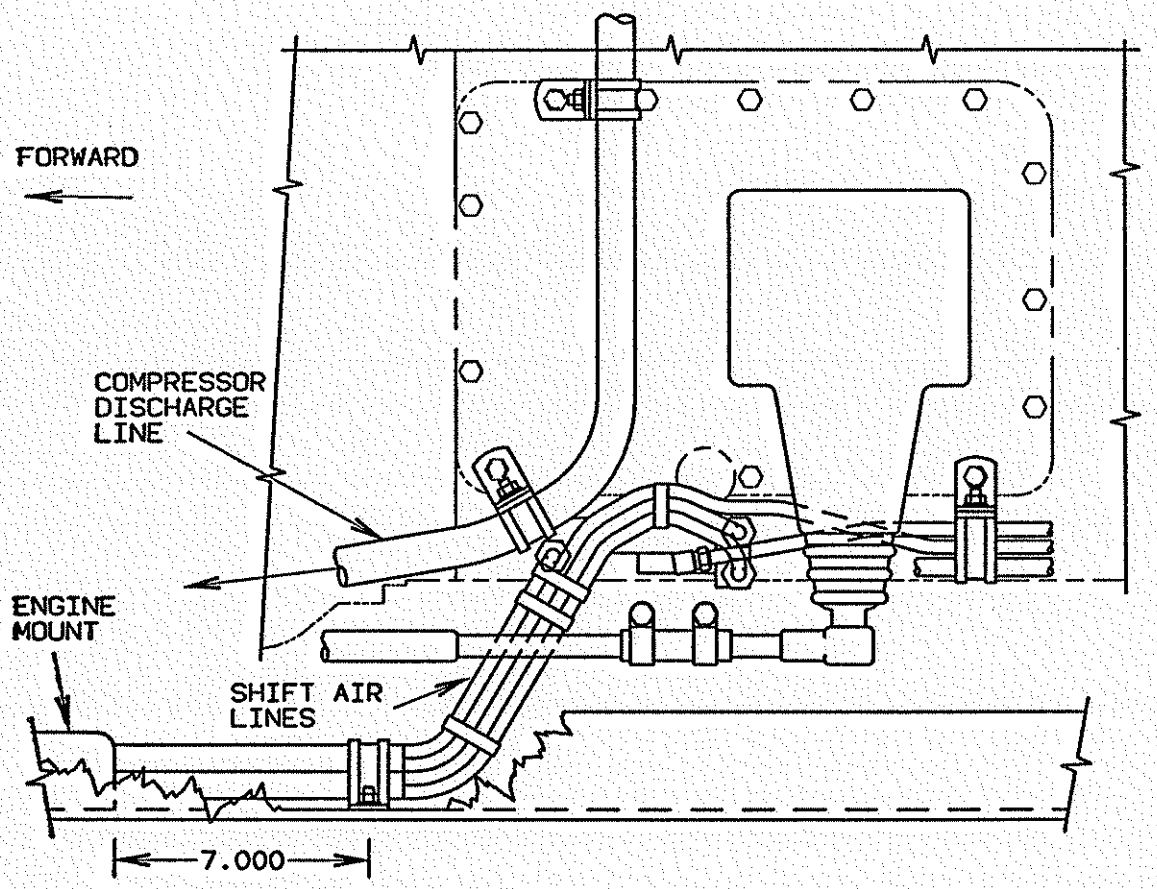


FIGURE 6

Compiled	HJR	SHOP PRACTICE AIR VALVE EXHAUSTS	33-12102
Approved	R.D. PHILLIPS		
Issued	4-7-65		
Revised	2-17-75	Chg Ltr D	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

1. Inside Cab

   Exhausting type valves should be vented outside the cab whenever a threaded hole is provided in the exhaust port, to avoid foul odors and, at times, unwanted noises. However, it is permissible to exhaust the transmission selector lines (1/8" dia.) in the cab due to the very low volume of air involved, also the air operated heater shutoff valve.

2. Outside Cab

   Valves should be positioned so that exhaust ports are down or not exposed to dripping water or wheel spray insofar as possible. Valves must also be located in protected places, yet accessible for maintenance.

Revised and Retyped "B" Chg.

COMPILED	H J R
APPRV	E TRAUB
ISSUE DATE	04/07/65
REV DATE	02/16/94
CHG LTR	C

SHOP PRACTICE

AIR SYSTEM ALLOWABLE PRESSURE DROP

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-12103

PAGE
1 OF 1

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0012-001 FOR AIR SYSTEM ALLOWABLE PRESSURE DROP.

AIR SYSTEM ALLOWABLE LEAKAGE

Note: This was previously contained in 33-12103.

PURPOSE

To establish a uniform method of checking the allowable pressure drop from an air system. This shop practice defines the maximum loss of air pressure allowed by Federal FMCSR regulations. It does not, nor is it intended to, amend or supersede any existing law or regulation.

PROCEDURE

Pressure drop from an air system of a single vehicle (truck or tractor without trailer) shall not exceed 2 psi in a 1 minute period when all air consuming devices are turned off, ie service brake released and park brake applied (exhausted). To check the air pressure drop:

a. Turn off all air consuming devices.
b. Run engine until the air system reaches full pressure (minimum compressor cut out pressure, 110 psi).
c. Stop the engine and wait 1 minute for the air pressure to stabilize. Note the reading on the air pressure gauge.
d. Wait for 1 minute, then re-check the reading on the gauge to see if there has been any pressure drop.
e. Pressure drop from air leakage must be less than 2 psi.

Pressure drop from an air system of a single vehicle (truck or tractor without trailer) shall not exceed 3 psi in a 1 minute period with service brake applied and park brake released (pressurized). To check the air pressure drop:

a. Place chocks under the wheels to prevent the vehicle from moving.
b. Turn all air consuming devices off.
c. Run engine until the air system reaches full pressure (minimum compressor cut out pressure, 110 psi).
d. Release the parking brakes.
e. Stop the engine and apply the brake pedal fully. Wait 1 minute for the air pressure to stabilize, then note the reading on the air pressure gauge.
f. Wait for 1 minute with the brake pedal still fully applied, then re-check the reading on the gauge to see if there has

been any drop in air pressure.

g. Pressure drop from air leakage must be less than 3 psi.

REVISIONS: (ALL REVISIONS ARE MADE BY CORPORATE MANUFACTURING ENGINEERING)

REV LVL	DATE REVISED	REVISIONS MADE	REVISED BY

COMPILED	B.PHILLIPS	SHOP PRACTICE COMPRESSOR DISCHARGE LINE	SECTION NUMBER 33-12104
APPRV	DJL		PAGE 1 OF 2
ISSUE DATE	03/03/69	FREIGHTLINER CORPORATION PORTLAND, OREGON	
REV DATE	06/30/95		P4704M-01
CHG LTR	R		

A. WITH AIR DRYERS (AFTERCOOLERS)

DISCHARGE LINES ARE TYPICALLY OF 2-PIECE CONSTRUCTION. THE CHART BELOW SHOWS MINIMUM LENGTHS FOR TEFLON, MINIMUM LENGTHS FOR TOTAL SYSTEMS, AND MAXIMUM LENGTHS WHERE APPLICABLE.

	NO OF COMP CYL.	DISCHARGE LINE LENGTH (IN FEET)		
		TEFLON (MIN)	TOTAL SYSTEM (MIN)	TOTAL SYSTEM (MAX)
AEROQUIP	1,2	6.0	9.0	
AEROFINER II	2*4	6.0	13.0	
ANCHORLOK	1,2,4	4.5	7.0	10.0
BAKER	1,2,4	4.5	7.5	
BENDIX	1,2	4.5	6.0	20.0
	2*4	4.5	14.0	20.0
CR/BRAKEMASTER	1,2,4	4.5	12.0	
RACOR	1,2,4	4.5	7.5	
SALEM	1,2,4	4.5	7.5	
STRATOFLEX	1,2,4	4.5	7.5	

* 2 CYLINDER, 30 CFM CUMMINS COMPRESSOR, DUE TO PRESSURE PULSES.

NOTE: DO NOT PAINT AIR DRYERS (AFTERCOOLER) UNDER ANY CIRCUMSTANCES. PAINTING WILL GREATLY REDUCE THE ABILITY TO COOL AND THUS DRY THE AIR.

COMPILED	B.PHILLIPS	SHOP PRACTICE COMPRESSOR DISCHARGE LINE	SECTION NUMBER 33-12104
APPRV	DJL		
ISSUE DATE	03/03/69		PAGE 2 OF 2
REV DATE	06/30/95	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	R		P4704M-01

B. ALL VEHICLES

R DISCHARGE LINES SHALL BE ROUTED FROM THE COMPRESSOR IN A CONTINUOUS DOWNWARD SLOPE TO THE WET TANK OR AIR DRIER INLET. IF THE DISCHARGE LINE HAS TO BE ROUTED UPHILL, DO SO IMMEDIATELY WHEN LEAVING THE COMPRESSOR, THEN RUN DOWNHILL THE REMAINDER OF THE ROUTING. MOISTURE SHALL NOT BE FORMED IN THE DISCHARGE LINE. IF THIS CANNOT BE AVOIDED, THE MAXIMUM UPWARD DISPLACEMENT IS LIMITED TO 1/2 THE HOSE DIAMETER RELATIVE TO ITS LOWEST POINT.

C. WITH BENDIX AD-9 AIR DRYER

ALL DISCHARGE LINES THAT DROP BELOW THE FRAME RAIL AND GO TO INLET FITTING OF AD-9 MUST BE INSULATED FOR THE FINAL 3 FEET WITH 1/2 INCH THICK CLOSED CELL POLYETHYLENE TUBING INCLUDING THE FITTING ITSELF. A STRAIGHT CONNECTOR AT THE AIR DRYER INLET IS PREFERRED, BUT A 45° ELBOW MAY BE SUBSTITUTED IN COMPACT MOUNTING AREAS. SECURE TUBING USING PLASTIC TIE STRAPS.

Compiled	McWilliams	SHOP PRACTICE SUBSTITUTION OF FITTINGS	33-12105
Approved	DJL		
Issued	12-19-86		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

FITTING SUBSTITUTION

NO BLACK IRON, GALVANIZED IRON OR CARBON STEEL FITTINGS OR PIPE ARE TO BE USED OR SUBSTITUTED IN ANY PART OF THE VEHICLE AIR SYSTEMS UNLESS SPECIFIED OR APPROVED BY FREIGHTLINER PRODUCT ENGINEERING OR CUSTOM ENGINEERING DEPARTMENTS ON AN ENGINEERING DRAWING OR VEHICLE SPECIFICATION SHEET.

COMPILED	LELANCHON	SHOP PRACTICE ASSEMBLING FLEXIBLE HOSES	SECTION NUMBER 33-12106
APPRV	QUTUB		
ISSUE DATE	12/10/85		PAGE 1 OF 1
REV DATE	07/29/96		
CHG LTR	A	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0012-002/003 FOR ASSEMBLING FLEXIBLE HOSES PROCEDURE.

A. GENERAL

A few simple precautions can greatly improve the service life and safety of flexible hoses used for brake system piping.

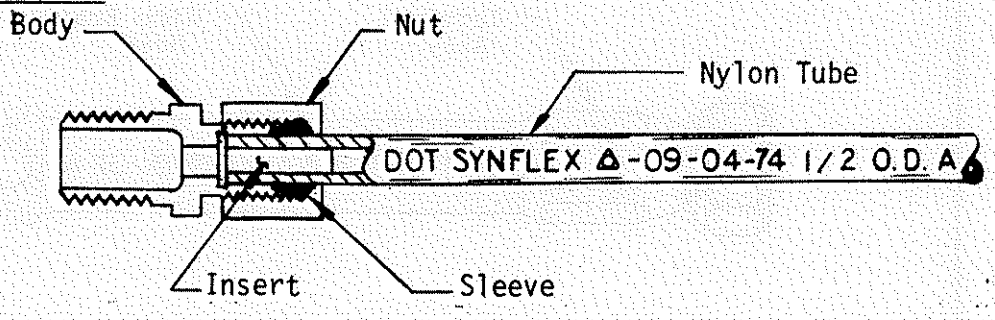
Hose, fittings, and hose assemblies called out on A23-XXXXX drawings may be freely used where applicable, if items are of same manufacturer, if not, they must be approved by Corporate Engineering before use on a vehicle.

NOTE: This applies to Canada built units only, does not comply with FMVSS #121.

B. ASSEMBLY & INSTALLATION OF WIRE BRAID HOSE, NYLON TUBE & HOSE ASSEMBLIES FOR AIR BRAKE & NON-AIR BRAKE USE

Federal Motor Vehicle Safety Standard #106 establishes labeling and performance requirements for air brake applications of air brake hose, end fittings and hose assemblies. To insure compliance with these requirements, the following procedures must be adhered to. No deviations are permitted without prior written approval from Corporate Engineering.

1. Nylon Tube



a. Observe the following when attaching end fittings to nylon tubing:

(1) Cut the end of the tubing smooth and square.
(2) DO NOT remove the nut and sleeve from the fitting.
(3) Be sure that the tubing is bottomed in the body of the fitting.
(4) Torque the nut down as follows:

(a) Tighten finger tight.
(b) Metal sleeve fitting (NTA type) - Tighten with a wrench until only two threads show on the body. DO NOT tighten beyond this point as it will be very difficult to remove the tube.

b. Maintain cleanliness in all operations associated with nylon tubes and fittings, including storage, assembly, and installation.

*Cross Ref: 33-12101 Routing of Flexible Lines, Brake (General).

Nylon Tube (Continued)

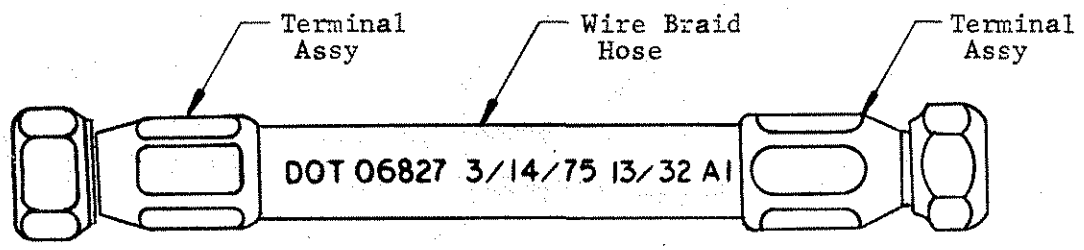
c. Do not use damaged fittings. Any tubing that is crimped or otherwise damaged must be replaced. When replacing a damaged tubing, install new sleeves also.

d. Precaution must be taken in installation not to exceed the minimum bend radii. The minimum bend radii are as follows:

NYLON TUBE SIZE	MINIMUM BEND RADIUS
#4	1.00 inch
#6	1.50 inches
#8	2.00 inches
#10	2.50 inches
#12	3.00 inches

e. To repair or add on to existing nylon tubing, use 23-11002 union, and follow above procedures, and secure union to rail.

2. Wire Braid Hose



a. All components of a reuseable end fitting must be of the same manufacture as the wire braid hose that they are attached to.

b. Attach the terminals (reuseable end fittings) to wire braid hose with a special assembly tool and the following procedure:

(1) Cut the hose to the desired length with a fine toothed hacksaw or a cut-off wheel. The ends must be square and clean.
(2) Place a socket in a vise and screw the hose in counter-clockwise until it bottoms. Back the hose out 1/4 turn.
(3) Oil the nipple threads, the assembly tool mandrel and the inside of the hose liberally.
(4) Tighten the nipple and nut on the assembly tool and then oil. Screw the nipple clockwise into the socket and hose. Leave 1/32 inch to 1/16 inch clearance between the nut and the socket so that the nut will swivel.

Wire Braid Hose (Continued)

c. Maintain cleanliness in all operations associated with hoses, fittings, and hose assemblies, including storage, assembly and installation.

d. Do not use damaged fittings, hoses or hose assemblies.

e. Torque a hose assembly at installation as follows:

(1) Tighten the nut hand tight.
(2) Tighten the nut with a wrench until a solid feeling is encountered.
(3) Tighten ONE SIXTH turn more. Do not overtorque.

f. Purchased hose assemblies used in the air brake system must have a band attached by the assembler with FMVSS #106 data inscribed on it. Do NOT remove this band.

3. Non-Air Brake Hose

The previous assembly and installation procedures will contribute to the service life and performance of nylon tubing and wire braid hose in all applications and therefore, where applicable, should be followed for non-air brake use.

4. REFRIGERANT HOSE-FITTING ASSEMBLY

Refrigerant lubrication oil must be used on all refrigerant fittings on refrigerant hose assemblies. Fittings must also be completely tightened to seated position and not partially assembled.

COMPILED	SJH	SHOP PRACTICE AIR GOVERNOR	SECTION NUMBER 33-12107
APPRV	BRAY		
ISSUE DATE	05/25/70		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

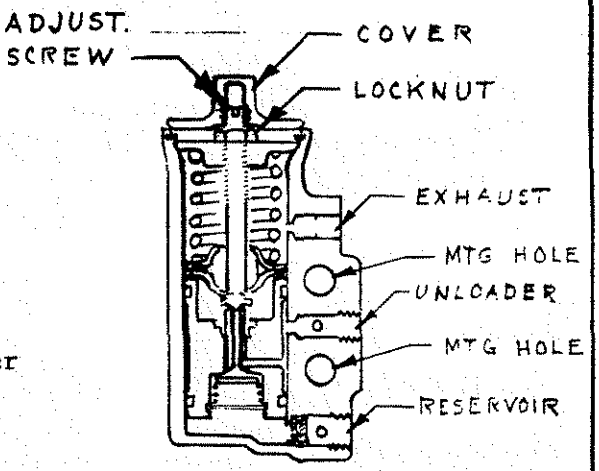
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0012-004 FOR AIR GOVERNOR PROCEDURE.

Compiled	SJH	SHOP PRACTICE AIR GOVERNOR	33-12107
Approved	BRAY		
Issued	5-25-70	CHG C FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-21
Revise	2-18-83		

PRESSURE ADJUSTMENT

When the (EW) D-2 Air Governor pressure setting must be changed:

a. Unscrew protective cover at the top of the governor.
b. Loosen the adjusting screw locknut.
c. With a screwdriver in the stem groove, turn the stem
   1) counterclockwise to increase the pressure
   2) clockwise to decrease the pressure
d. Retighten locknut
e. Test (with an accurate gauge) for proper setting, repeating from step "b", as necessary.
f. Replace protective cover.



D-2 GOVERNOR

PRESSURE SETTINGS (ALL AIR GOVERNORS)

Cut-in pressure	95 to 100 P.S.I.
Cut-out pressure	115 to 125 P.S.I.

C

GOVERNOR AIR LINE

The line from the governor to the wet tank must be in a continuous down grade and free of dips and loops that could collect water and sludge.

Compiled	S. FRANKLIN	SHOP PRACTICE NYLON TUBE COLOR CODE CANADA BUILT UNITS	33-12108 Page 1 of 2
Approved	R. PHILLIPS		
Issued	6/21/71		
Revised	4-15-83	Chg Ltr D FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-21

COLOR CODE NYLON TUBE IN-CAB NOTE: Canada built units only, does not comply with FMVSS #121.

When colored nylon tube is to be used within the cab, its use must comply with the intended purpose of color coding, that is, to distinguish the lines leading to various systems; to create a recognizable pattern in the piping processes; to aid in any requirements for trouble-shooting.

The following chart lists the applications of color coded nylon tube in cab:

SYSTEM	FROM	TO	COLOR	SIZE*
AIR HORN	CAB JCT. BLOCK AIR HORN VLV	AIR HORN VLV AIR HORN	BLACK BLACK	6 4
AIR START	ANCHOR CPLG, IN AIR START VLV	AIR START VLV ANCH CPLG, OUT	BLACK ORANGE	4 4
D DEEP REDUCTION (TRANS-MISSION)	ANCH CPLG, IN 2-WAY VALVE	2-WAY VALVE ANCH CPLG, OUT	ORANGE ORANGE	4 4
EMERGENCY RELEASE	ANCH CPLG	CONTROL VLV	GREEN	4
D EXHAUST BRAKE, WILLIAMS	ANCH CPLG	CONTROL VLV	ORANGE	4
FIFTH WHEEL, SLIDING	CAB JCT BLOCK 2-WAY VALVE	2-WAY VALVE ANCH CPLG	BLACK ORANGE	4 4
FRONT WHEEL BRAKES	ANCH CPLG, IN 2-WAY VALVE	2-WAY VALVE ANCH CPLG, OUT	BLUE BLUE	4 4
GAUGES: APPLICATION, AIR ENGINE OIL PRESSURE FUEL PRESSURE RESERVOIR, AIR RESTRICTION INDIC TURBO AIR PRESSURE TURBO OIL PRESSURE	 CAB JCT BLOCK CAB JCT BLOCK ANCH CPLG SUPPLY, AIR ANCH CPLG ANCH CPLG ANCH CPLG	 GAUGE GAUGE GAUGE GAUGE INDICATOR GAUGE GAUGE	 WHITE TAN BLACK BLACK ORANGE ORANGE ORANGE	 4 4 4 4 4 4 4
HEATER VALVE, AIR OP.	CONST. AIR	HTR VALVE	RED	4
HAND VALVE, TRAILER CONVENTIONAL	CAB JCT BLOCK HAND VLV, DEL CAB JCT BLOCK	HAND VLV, SUP CAB JCT BLOCK DOUBLE CHECK VALVE	YELLOW BLACK SILVER	6 6 6
INTERAXLE DIFF. LKOUT	SUPPLY, AIR 2-WAY VALVE	2-WAY VALVE ANCH CPLG	BLACK ORANGE	4 4
MANIFOLD, 2-WAY VLAVE	CAB JCT BLOCK	MANIFOLD	BLACK	4

Compiled	S. FRANKLIN	SHOP PRACTICE NYLON TUBE COLOR CODE CANADA BUILT UNITS	33-12108 Page 2 of 2
Approved	R. PHILLIPS		
Issued	6/21/71		
Revised	4/15/83 Chg Ltr D	FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-21

NOTE: Canada built units only, does not comply with FMVSS #121.

SYSTEM	FROM	TO	COLOR	SIZE
PARKING BRAKE	CAB JCT BLOCK CONTROL VLV, D	CONTROL VLV, S STOPLT SW TEE	BLACK YELLOW	4 4
STOPLIGHT SWITCHES: TRACTOR TRAILER	 CAB JCT BLOCK SW.,SIDE PORT ANC. CPLG TEE	 STOPLT SW TEE CAB JCT BLOCK TRAILER SW	 YELLOW WHITE RED	 4 4 6
TRACTOR PROTECTION	CAB JCT BLOCK CONTROL VLV,D	CONTROL VLV, S ANCH CPLG TEE	BLACK RED	6 6
WIG-WAG WARNING	CAB JCT BLOCK	WIG-WAG	BLACK	4
WIPER, WINDSHIELD	CAB JCT BLOCK WIPER CON, PRK WIPER CON, OUT	WIPER CONTROL WIPER MOTOR WIPER MOTOR	BLACK PURPLE NATURAL	4 4 4

* See 48-100 or 48-101 of the materials specification group for the various sizes and colors.

Nylon tubing used in the cab will either conform to the above color code or will be black. Chassis lines will be black only.

REVISED & RETYPED 'B' CHANGE

COMPILED	JCG	SHOP PRACTICE AIR BRAKE TEST TRACTOR/TRAILER	SECTION NUMBER 33-12109
APPRV	DJL		PAGE 1 OF 1
ISSUE DATE	01/10/79	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-67
REV DATE	05/24/96		
CHG LTR	B		

THIS PROCEDURE TESTS FOR THE PROPER PLUMBING TO THE TRACTOR PROTECTION VALVE.

2-VALVE SYTEM

1. PLUG THE EMERGENCY SIDE OF THE TRACTOR PROTECTION VALVE EITHER AT THE DELIVERY PORT OR AT THE GLADHAND.

2. REMOVE ANY PLUG IN THE SERVICE LINE FROM THE TRACTOR PROTECTION VALVE.

3. MAKE SURE THAT THERE IS AT LEAST 80 PSI AIR PRESSURE IN THE PRIMARY AND SECONDARY AIR RESERVOIRS.

4. ENSURE THAT THE VEHICLE WILL NOT ROLL. PUSH IN BOTH THE RED AND YELLOW PARKING BRAKE KNOBS ON THE DASH BOARD.

5. STEP ON THE FOOT VALVE AND CHECK THAT AIR IS DELIVERED OUT OF THE SERVICE SIDE OF THE TRACTOR PROTECTION VALVE.

6. IF THE VEHICLE IS EQUIPPED WITH A TRAILER HAND VALVE, WITH THE FOOT VALVE NOT APPLIED PULL ON THE TRAILER BRAKE HANDLE AND CHECK THAT AIR IS DELIVERED OUT OF THE SERVICE SIDE OF THE TRACTOR PROTECTION VALVE.

7. PULL THE YELLOW KNOB OUT (RED KNOB WILL POP OUT AUTOMATICALLY) TO PARK THE VEHICLE AND REMOVE ANY PLUGS.

3-VALVE SYTEM

1. SAME AS ABOVE.

2. SAME AS ABOVE.

3. SAME AS ABOVE.

4. ENSURE THAT THE VEHICLE WILL NOT ROLL. PUSH IN THE YELLOW KNOB FIRST, THEN THE RED PARKING BRAKE KNOB ON THE DASH BOARD, THE BLUE KNOB CAN BE EITHER IN OR OUT.

5. SAME AS ABOVE.

6. SAME AS ABOVE.

7. PULL THE YELLOW KNOB OUT TO PARK THE VEHICLE AND REMOVE ANY PLUGS.

COMPILED	H J R	SHOP PRACTICE TIGHTENING PROCEDURES TUBE AND PIPE CONNECTIONS	SECTION NUMBER 33-12111
APPRV	D J L		PAGE 1 OF 1
ISSUE DATE	07/09/73		
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	H		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0012-005 FOR TUBE & PIPE CONNECTIONS TIGHTENING PROCEDURES.

COMPILED	HJR
APPRV	DJL
ISSUE DATE	07/09/73
REV DATE	07/06/95
CHG LTR	G

SHOP PRACTICE

TIGHTENING PROCEDURES TUBE & PIPE CONNECTIONS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-12111

P4825N-01

1. TIGHTENING HOSE CONNECTIONS

SEE 33-12106

2. TIGHTENING COPPER TUBE CONNECTIONS

TIGHTEN NUT FINGER TIGHT, THEN TIGHTEN FURTHER WITH WRENCH AS FOLLOWS:

FITTING SIZE	TUBE O.D.	TURNS REQUIRED TO SEAL FROM HAND TIGHT	
		COMPRESSION	THREADED SLEEVE
2 3 4	1/8 3/16 1/4	1 1/4	1 1/2
5	5/16	1 3/4	
6 8 10 12 16 20	3/8 1/2 5/8 3/4 1 1 1/4	2 1/4	

TABLE 1

3. TIGHTENING PIPE CONNECTIONS, BRASS OR STEEL

F

A. APPLY 48-00094-108 SEALANT IN SMALL QUANTITIES TO THE MALE FITTING THREADS THAT DO NOT HAVE PRE-COATINGS.

CAUTION: MAKE SURE THAT EXCESS SEALANT DOES NOT GET INSIDE EITHER THE MALE OR FEMALE FITTINGS. THIS COULD PROVIDE LOOSE FOREIGN MATERIAL INSIDE THE PLUMBING.

B. TIGHTEN FITTING FINGER TIGHT.

C. FOR FITTINGS THAT MUST BE POSITIONED, TIGHTEN ONE ADDITIONAL TURN WITH A WRENCH. FURTHER TIGHTEN THE FITTING UNTIL IT IS PROPERLY POSITIONED.

D. FOR FITTINGS THAT DO NOT REQUIRE POSITIONING, TIGHTEN 1 1/2 TURNS PAST FINGER TIGHT.

4. TROUBLE SHOOTING PIPE CONNECTION AIR LEAKS

A. DISASSEMBLE THE LEAKING JOINT: EXAMINE FOR CRACKS, THREAD DAMAGE OR OTHER DEFECTS.

B. REPLACE IF DEFECTIVE. OTHERWISE REAPPLY THREAD SEALANT AND REASSEMBLE ACCORDING TO TIGHTENING PROCEDURES ABOVE. DO NOT SIMPLY OVERTIGHTEN A LEAKING FITTING. MANY TIMES THIS WILL ONLY CREATE ADDITIONAL PROBLEMS AND THE FITTING CAN STILL LEAK.

5. TIGHTENING TUBE & PIPE FITTINGS TO PLASTIC COMPONENTS

COMPONENT	TORQUE LIMITS
MIDLAND PLASTIC QUICK RELEASE VALVE 3/8" NPT PORTS 1/2" NPT PORTS MOUNTING HOLES	 60 TO 90 IN-LBS 160 TO 200 IN-LBS 20 TO 21 FT-LBS (WITH STEEL WASHER UNDER BOLT HEAD)
BENDIX MV-2/MV-3 PLASTIC DASH VALVE 1/4" NPT PORTS	 10 FT-LBS MAXIMUM

TABLE 2

E

TORQUE TO LOWER LIMITS AND ROTATE ALL FITTINGS AS REQUIRED TO ALLOW PROPER ROUTING OF AIR LINES. E

6. TIGHTENING NYLON TUBING TO NYLON TUBE FITTINGS.

A. IF THE NYLON TUBE FITTING IS CLEARLY VISIBLE, USE THE FOLLOWING TIGHTENING PROCEDURE:

1. INSTALL THE NYLON TUBING INTO THE FITTING ENSURING THAT THE TUBE BOTTOMS OUT AT THE SLEEVE BASE.
2. HAND TIGHTEN THE NUT FINGER TIGHT.
3. USE A WRENCH TO TIGHTEN FURTHER UNTIL ONE THREAD IS SHOWING (3-4 TURNS AFTER FINGER TIGHT).

B. USE THE FOLLOWING PROCEDURE IF THE NYLON TUBE FITTING NUT IS NOT SUFFICIENTLY VISIBLE TO VIEW THE FITTTING THREADS.

1. COMPLETE STEPS 6A1 AND 2.
2. TIGHTEN THE FITTING NUT IN ACCORDANCE WITH THE VALUES SHOWN IN TABLE 3.

TUBE SIZE	TUBE O.D.	NUT TIGHTENING TORQUE VALUES (FT.LBS.)
4	1/4	7
6	3/8	10
8	1/2	17
10	5/8	22
12	3/4	30

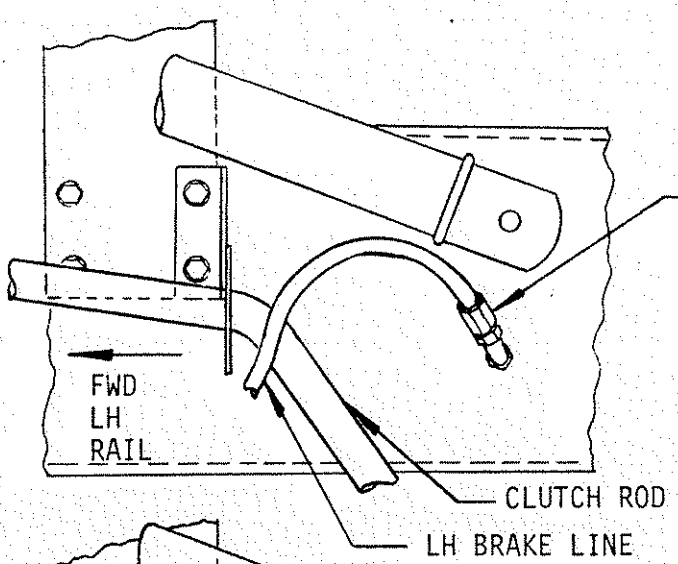
TABLE 3

Compiled	S. Heileson	SHOP PRACTICE LH BRAKE LINE ROUTING CLUTCH ROD CLEARANCE	33-12112
Approved	[signature]		
Issued	7-30-80		
Revised		Chg Ltr	P*A078-21

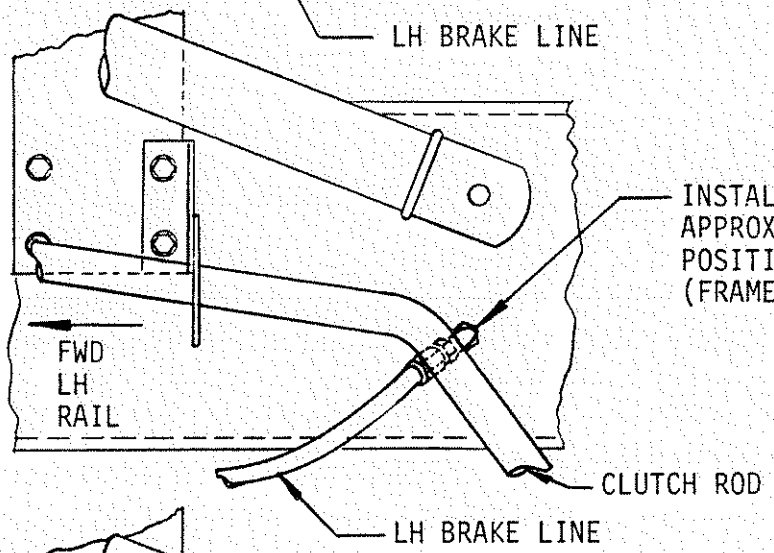
FREIGHTLINER CORPORATION
PORTLAND, OREGON

ROUTING OF LH BRAKE LINE FOR CLUTCH ROD CLEARANCE

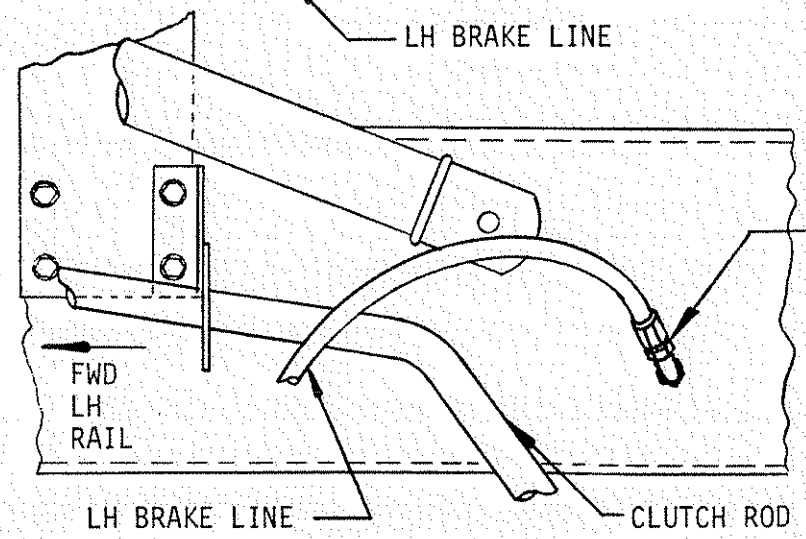
DDE 6V INSTALLATION ONLY



ALL OTHER INSTALLATIONS EXCEPT 6V OR 10.12 RAILS



ALL INSTAL-LATIONS WITH 10.12 STEEL RAILS



COMPILED	DJL	SHOP PRACTICE SAFETY VALVE ORIENTATION	SECTION NUMBER 33-12113
APPRV	DJL		PAGE 1 OF 1
ISSUE DATE	07/26/83		
REV DATE	06/28/95	FREIGHTLINER CORPORATION PORTLAND, OREGON	P4704M-01
CHG LTR	A		

A. GENERAL

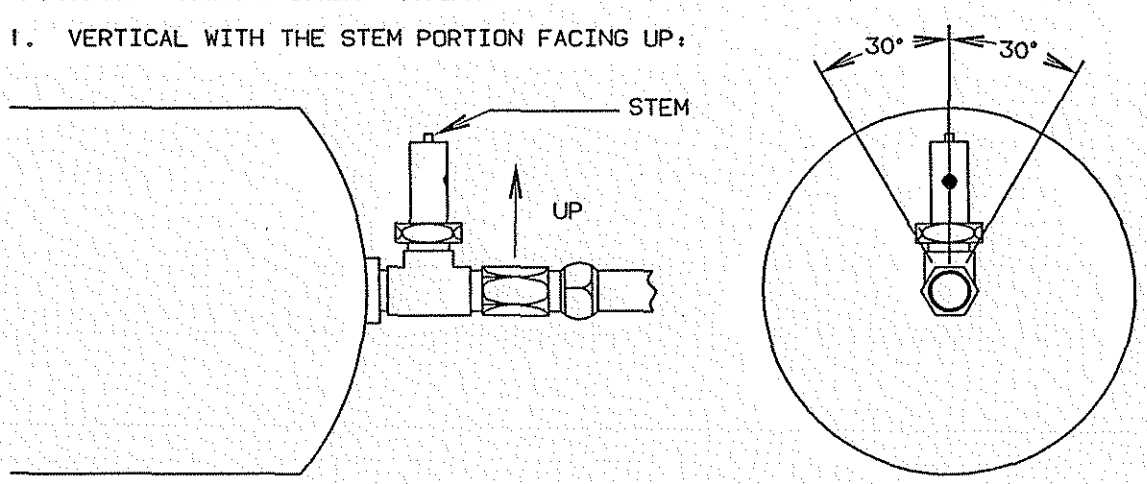
TO REDUCE THE CHANCES OF MOISTURE COLLECTING AND FREEZING IN OR AROUND THE SAFETY VALVE VENT HOLE OR STEM, CARE MUST BE TAKEN TO ORIENT THE VALVE AS SHOWN BELOW.

THE VALVE BODY MUST BE FREE OF PAINT AND LOCATED IN AN AREA PROTECTED FROM HEAT AND WHEEL WASH.

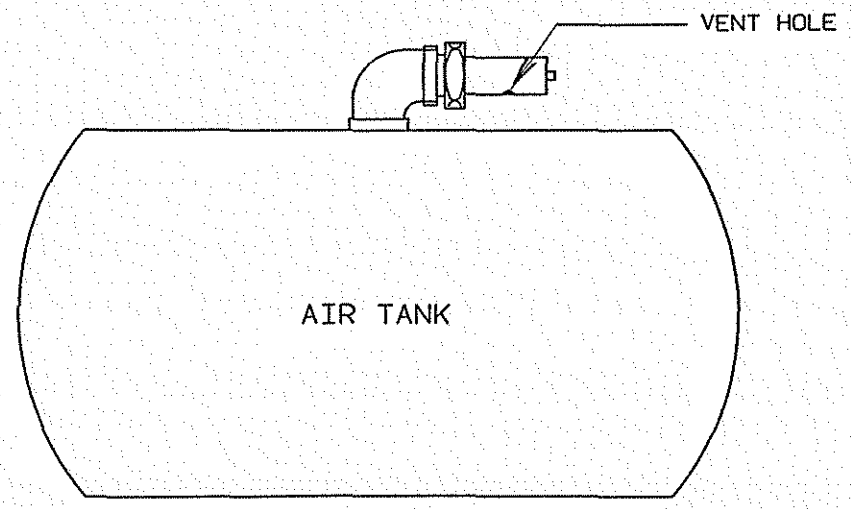
B. APPROVED VALVE ORIENTATIONS

1. VERTICAL WITH THE STEM PORTION FACING UP:

A



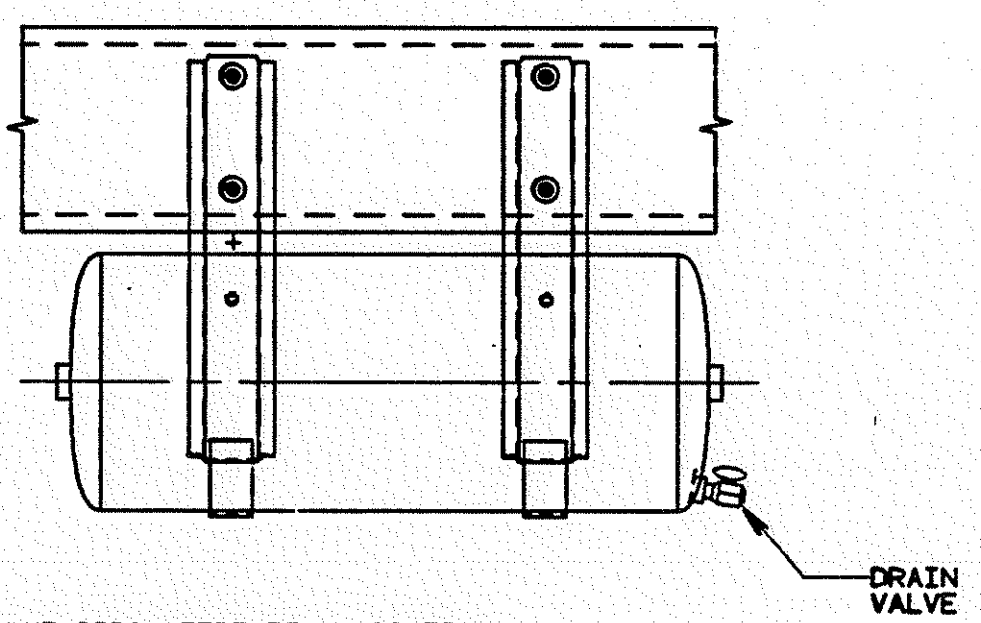
2. HORIZONTAL WITH THE VENT HOLE FACING DOWN. DO NOT MOUNT TO LOW AREA OF AIR TANK WHERE MOISTURE CAN DRAIN AND COLECT.



Compiled	DWP	SHOP PRACTICE	33-12114
Approved	EAM	AIR TANK MOUNTING TO FRAME RAIL	
Issued	12-24-87		
Revised	5-19-88	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

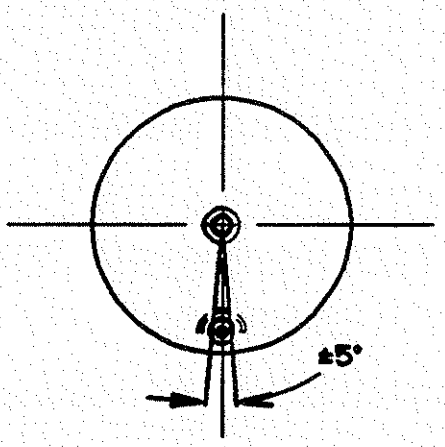
A. END TO END OUT OF LEVEL

DRAIN VALVE END OF TANK TO BE LEVEL WITH OR BELOW OPPOSITE END BY .375" MAXIMUM.



B. DRAIN VALVE CIRCUMFERENTIAL LOCATION

DRAIN VALVE SHALL BE LOCATED ON THE BOTTOM SIDE OF THE AIR TANK WITHIN ±5° OF VERTICAL.



Compiled	DJL
Approved	
Issued	3-11-86
Revised	

SHOP PRACTICE
EJECTOR VALVE PLUMBING

33-I2115

Chg Ltr

FREIGHTLINER CORPORATION
PORTLAND, OREGON

Automatic Ejector & Aftercooler Drain Valve Plumbing

When more than one automatic ejector valve is installed, separate air lines must be run to the governor. The lines should not be connected to each other as improper valve action can result.

The only exception to the above plumbing practice is when the number of automatic ejector valves exceeds the number of ports on the governor. Under this condition only should a tee be used and the tee should be installed as close to the governor as possible.

1. Chassis and Cab Plumbing Diagrams

Compliance with FMVSS #121 air brake requirements is dependent on vehicles being plumbed per diagrams listed on 33-12130 pages 2 & 3.

Use only fittings, hoses, nylon tube and all other air brake components specified on the diagrams or in the parts book.

All deviations other than those listed below must have written approval from Corporate Engineering.

Deviations acceptable in cab interior plumbing: Fitting configuration may be changed but size and tubing color must be maintained.

Deviations acceptable in chassis plumbing:

A. For acceptable deviations for use with nylon tube. (See 33-12130 pages 4 & 5)

B. For acceptable deviations for use with wire braid hose. (See 33-12130 pages 6 & 7)

C. For acceptable deviations for use with nylon tube and wire braid hose in Conventional cabs see 33-12130 pages 8 & 9.

NOTE: Deviations other than those listed could adversely affect the brake timing requirements and invalidate our compliance certificate.

Deviations not acceptable in chassis plumbing: No equipment such as automatic sludge ejectors or automatic lubers should be operated from the brake application air line as it could effect the brake system timing.

FMVSS COMPONENT IDENTIFICATION

Anti-Lock modulation valves are to be serial numbered as shown on D06-11685. Decals to be applied after painting and duplicates are to be placed on form QC-56.

ORIENTATION OF 12-10492, SPECIAL TEE

Tee must be installed with 3/8" port pointed upward.

Diagrams as follows for compliance with FMVSS #121:

CHASSIS PLUMBING DIAGRAMS, AIR BRAKE

VEHICLE TYPE		NYLON TUBE	WIRE BRAID HOSE
COE	6 X 4 TRACTOR	D12-10512 D12-10972	D12-10578 D12-10962
	4 X 2 TRACTOR	D12-10516 D12-10971	D12-10577 D12-10963
	6 X 4 TRUCK	D12-10493 D12-10964	D12-10584 D12-10956
	4 X 2 TRUCK	D12-10496 D12-10965	D12-10583 D12-10953
CONVENTIONAL	6 X 4 TRACTOR	D12-11478	D12-11481
	4 X 2 TRACTOR	D12-11479	D12-11480
	6 X 4 TRUCK	D12-11476	D12-11483
	4 X 2 TRUCK	D12-11477	D12-11482

CAB PLUMBING DIAGRAMS

VEHICLE TYPE	NYLON TUBE W/HAND VALVE	NYLON TUBE W/O HAND VALVE	WIRE BRAID HOSE W/HAND VALVE	WIRE BRAID HOSE W/O HAND VALVE
A COE (TRACTOR)	D12-10513 D12-10292	D12-10576 D12-10298	D12-10513 D12-10292	D12-10576 D12-10298
COE (TRUCK)	D12-10535 D12-10292	D12-10572 D12-10298	D12-10535 D12-10292	D12-10572 D12-10298
B CONVENTIONAL (TRACTOR)	D12-10677	D12-10681	D12-10676	D12-10680
B CONVENTIONAL (TRUCK)	D12-10679	D12-10682	D12-10678	D12-10683

Diagrams as follows for compliance with FMVSS #121:

CONTROL VALVE PLUMBING DIAGRAM

VEHICLE TYPE	DIAGRAM NUMBER
ALL	D12-10501 D12-10293

ANTI-LOCK SYSTEMS, CHASSIS DIAGRAMS	
(WAG) WAGNER	D12-10554
(ROK) ROCKWELL	D12-10559
(KH) KELSEY-HAYES	D12-10560

BRAKE FOOT VALVE PLUMBING DIAGRAMS

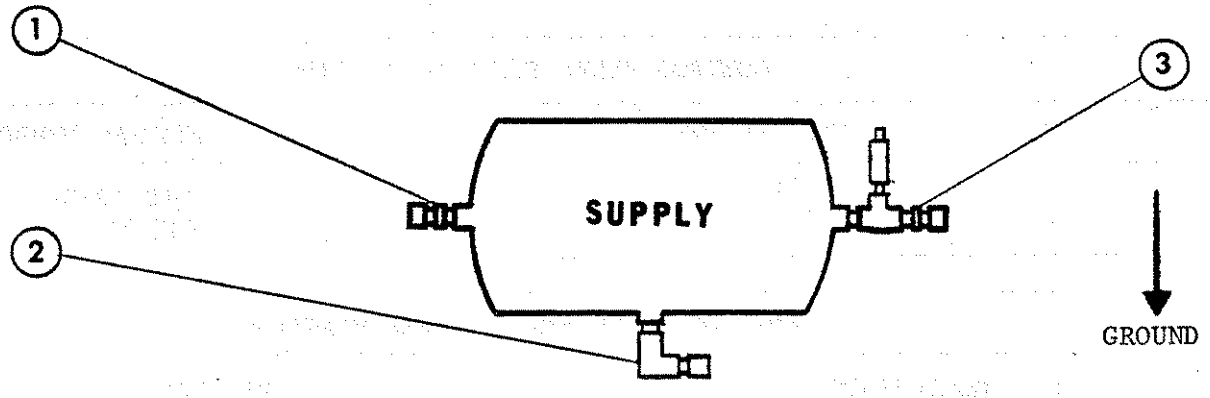
VEHICLE TYPE	NYLON TUBE	WIRE BRAID HOSE
COE	D12-10504	D12-10504
CONVENTIONAL	D12-10625	D12-10625

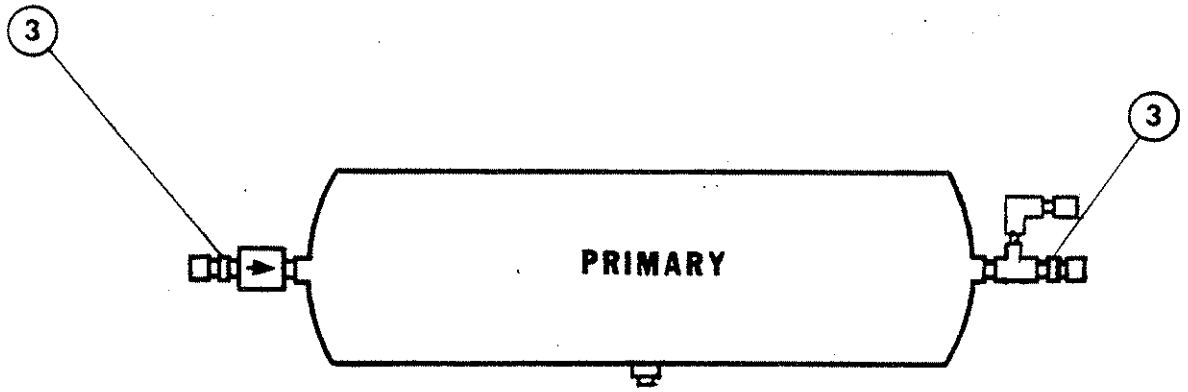
COMPONENT LOCATING DIAGRAMS FMVSS #121	
FORWARD FRAME RAIL SECTION	D12-10539
SUSPENSION SECTION, FREIGHTLINER SUSP. (4 X 2)	D12-10540*
SUSPENSION SECTION, FREIGHTLINER SUSP. (6 X 4)	D12-10541*

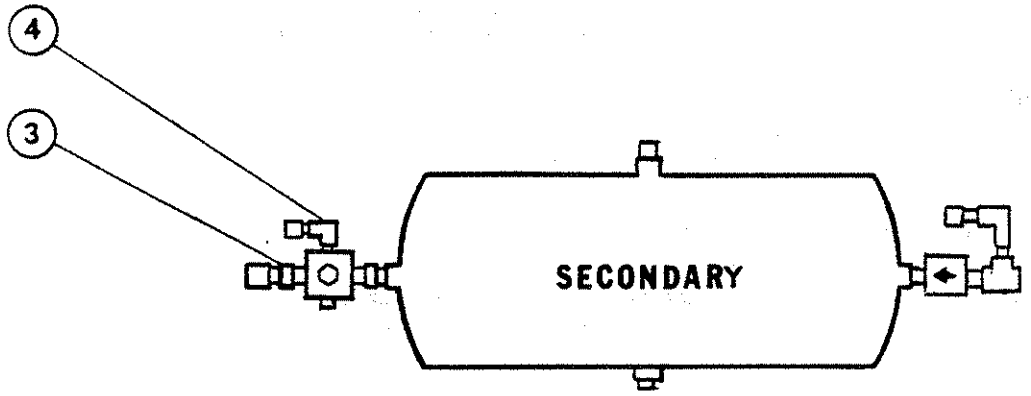
*Locating sequence of components to be maintained with all suspensions. See Frame Data Book for drilling diagrams and locations.

NOTE: If the diagrams don't answer your question, contact Corporate Engineering.

2. Fitting substitution, acceptable deviations for chassis plumbing





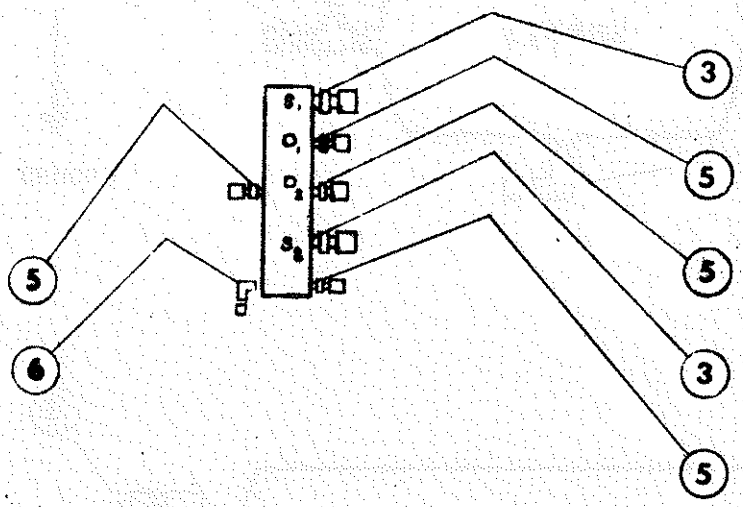


FOR NYLON TUBE

Fitting substitution, acceptable deviations for chassis plumbing (Continued)

A

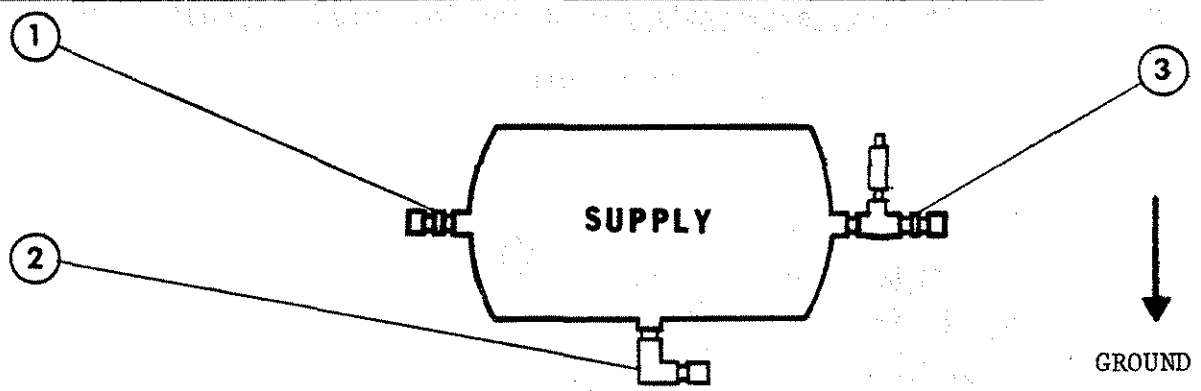
FOR NYLON TUBE

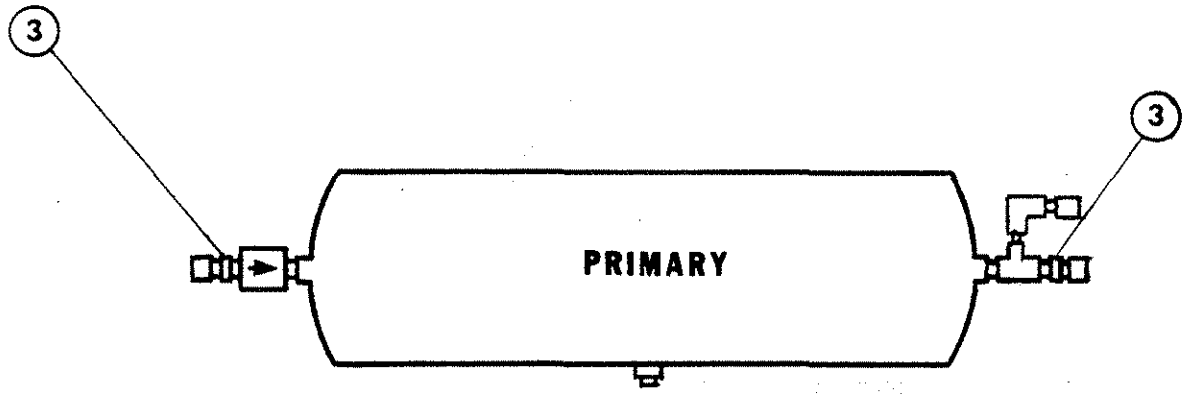


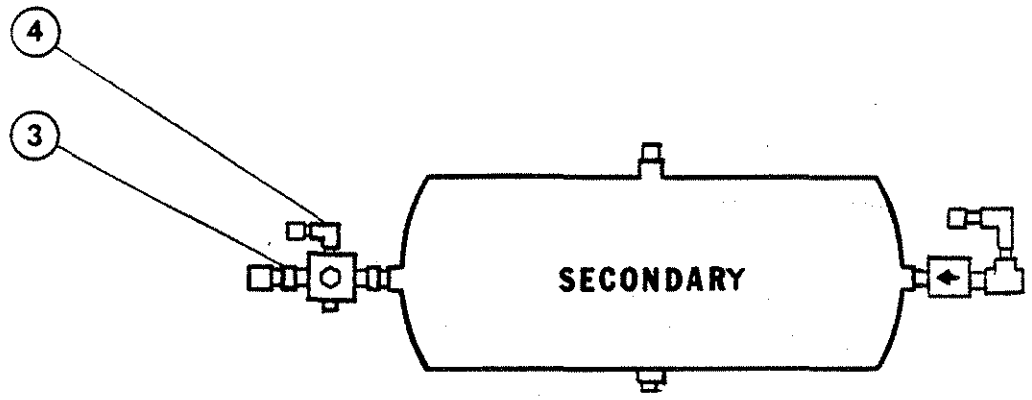
NO.	PREFERRED FITTING
1	23-9327-046, Male Connector
2	23-9295-015, 90° Male Elbow
3	23-9301-021, Male Coupling
4	23-9328-022, 90° Male Elbow
5	23-9301-012, Male Coupling
6	23-9328-023, 90° Male Elbow

NO.	ACCEPTABLE SUBSTITUTION
1	23-9326-046, 45° Male Elbow
2	23-9301-021, Male Coupling; 23-9293-009, 45° Male Elbow
3	23-9293-009, 45° Male Elbow
4	23-9327-022, Male Connector; 23-9326-022, 45° Male Elbow
5	23-9293-005, 45° Male Elbow
6	23-9327-023, Male Connector; 23-9326-023, 45° Male Elbow

Fitting substitution, acceptable deviations for chassis plumbing (Continued)





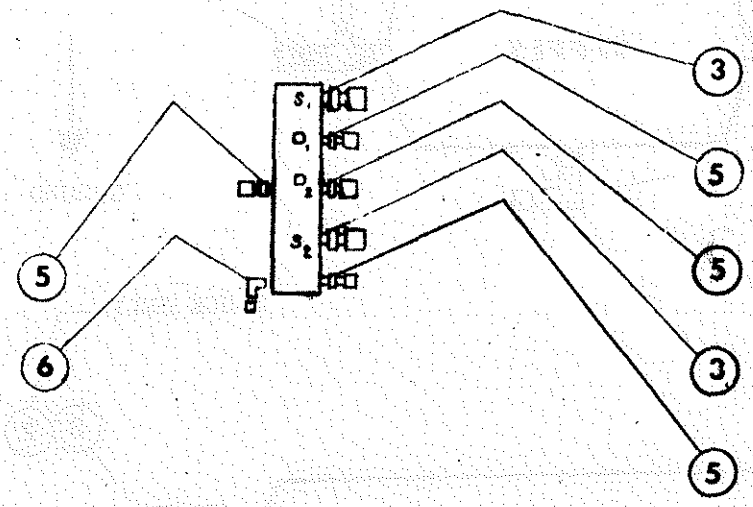


FOR WIRE BRAID HOSE

A

Fitting substitution, acceptable deviations for chassis plumbing (Continued)

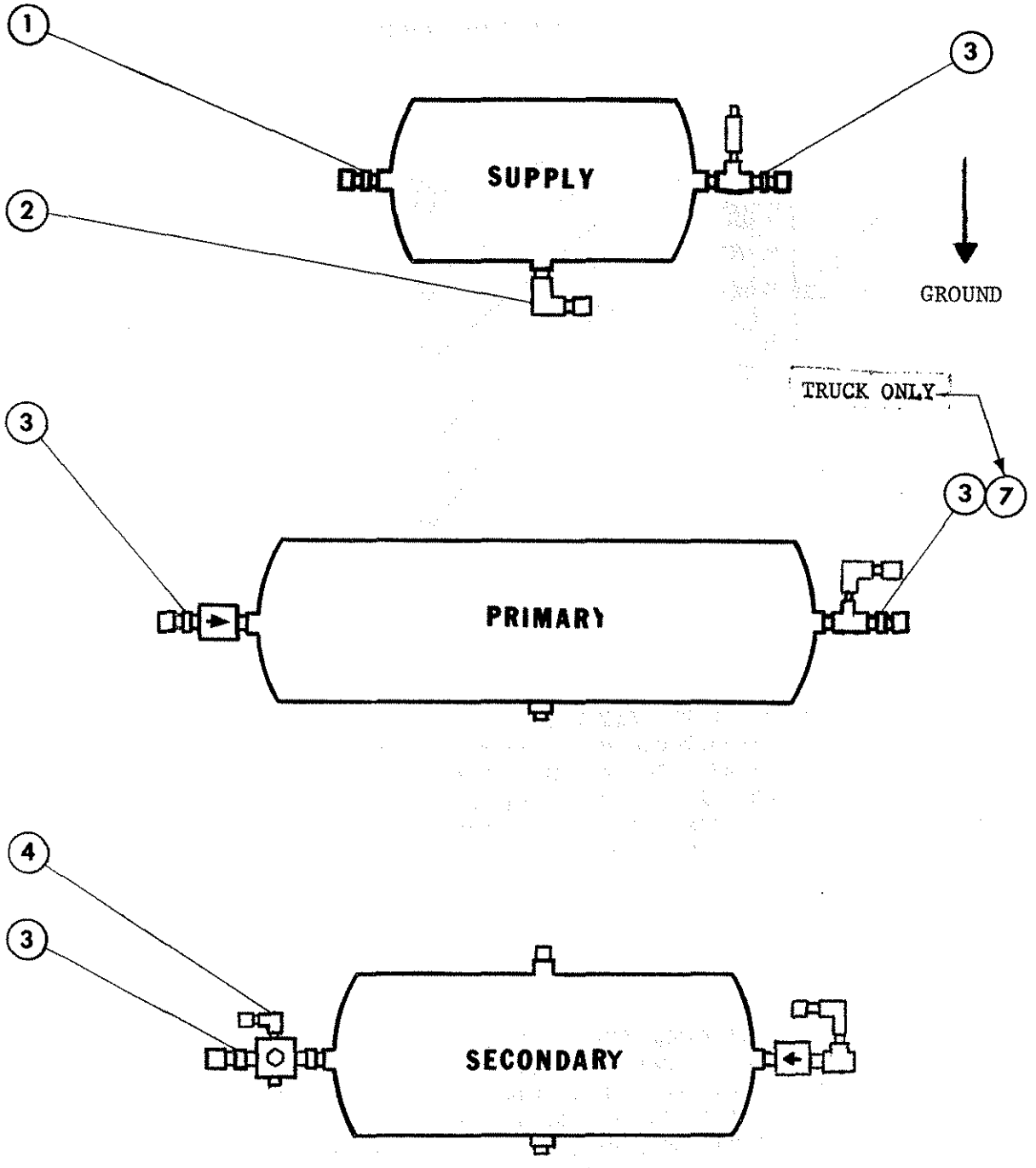
FOR WIRE BRAID



NO.	PREFERRED FITTING
1	23-9327-046 Male Connector
2	23-9328-044 90° Male Elbow
3	23-9327-044 Male Connector
4	23-9328-022 90° Male Elbow
5	23-9327-023 Male Connector
6	23-9328-023 Male Elbow

NO.	ACCEPTABLE SUBSTITUTION
1	23-9326-046 45° Male Elbow
2	23-9327-044 Male Connector; 23-9326-044, 45° Male Elbow
3	23-9326-044 45° Male Elbow
4	23-9327-022 Male Connector; 23-9326-022, 45° Male Elbow
5	23-9326-023 Male Elbow
6	23-9327-023 Male Connector; 23-9026-023, 45° Male Elbow

Fitting substitution, acceptable deviations for chassis plumbing (Continued)



FOR NYLON TUBE & WIRE BRAID HOSE IN CONVENTIONAL CAB

Fitting substitution, acceptable deviations for chassis plumbing (Continued)

FOR NYLON TUBE & WIRE BRAID HOSE IN CONVENTIONAL CAB

A. NYLON TUBE

NO.	PREFERRED FITTING
1	23-9327-046, Male Connector
2	23-9295-015, 90° Male Elbow
3	23-9301-021, Male Coupling
4	23-9328-022, 90° Male Elbow
5	23-9301-012, Male Coupling
6	23-9328-023, 90° Male Elbow
7	23-9301-018, Male Coupling

NO.	ACCEPTABLE SUBSTITUTION
1	23-9326-046, 45° Male Elbow
2	23-9301-021, Male Coupling; 23-9293-009, 45° Male Elbow
3	23-9293-009, 45° Male Elbow
4	23-9327-022, Male Connector; 23-9326-022, 45° Male Elbow
5	23-9293-005, 45° Male Elbow
6	23-9327-023, Male Connector; 23-9326-023, 45° Male Elbow
7	NO SUBSTITUTE

B. WIRE BRAID HOSE

NO.	PREFERRED FITTING
1	23-9327-046, Male Connector
2	23-9328-044, 90° Male Elbow
3	23-9327-044, Male Connector
4	23-9328-022, 90° Male Elbow
5	23-9327-023, Male Connector
6	23-9328-023, 90° Male Elbow
7	23-9327-044, Male Connector

NO.	ACCEPTABLE SUBSTITUTION
1	23-9326-046, 45° Male Elbow
2	23-9327-044, Male Connector; 23-9326-044, 45° Male Elbow
3	23-9326-044, 45° Male Elbow
4	23-9327-022, Male Connector: 23-9326-022, 45° Male Elbow
5	23-9326-023, 45° Male Elbow
6	23-9327-023, Male Connector; 23-9326-023, 45° Male Elbow
7	23-9326-044, 45° Male Elbow

3. Air Pressure Source for Non-Air Brake Requirements

A. Three air pressure sources have been designated by Corporate Engineering for all non-air brake air supply. Do not take air from any other location.

1. Cab constant air junction block: This air source is supplied by both air systems, primary and secondary, and is used for all safety related non-air brake requirements. Examples are: air throttle, air seat, engine shutdown, windshield washer/wiper, air horn etc., and any other requirement where this source is the most practicle to use.

2. Forward frame air junction block, located on the LH frame rail, port #3: This junction block is supplied by the primary system and is used for non-air brake requirements in the forward section of the vehicle.

3. Air junction block on the forward end of the secondary air reservoir, located on the LH frame rail, and is used for non-air brake requirements in the area of the transmission to the rear of the vehicle.

B. Refer to chassis and cab dual air brake plumbing diagrams for nylon tube color code for air brake use.

For non-air brake nylon tube use, air source and color code, see 33-12101 pages 2 thru 5 or 33-00130 pages 1 thru 4.

4. Foot Valve Assembly

For ease of assembly, bench assemble all fittings and hoses to foot valve.

B
A
B

Ref: D12-10504 Plumbing Diag, Foot Valve for COE.
D12-10625 Plumbing Diag, Foot Valve for Conventional cab;

A. Mark junction block end of hoses from foot valve ports S_2 and D_2 with red vinyl tape.

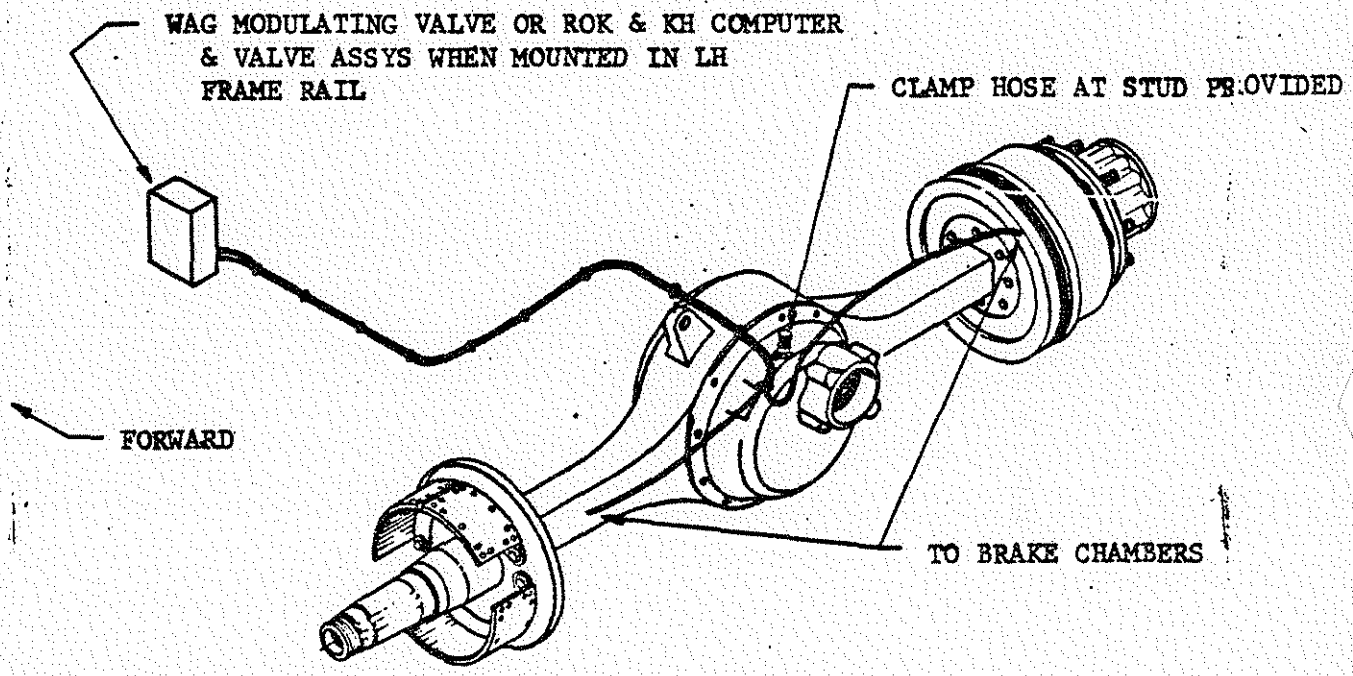
B. Mark junction block end of hoses from foot valve ports S_1 and D_1 with green vinyl tape.

Compiled	MURRELL	SHOP PRACTICE HOSE ROUTING, MODULATING VALVE TO BRAKE CHAMBER	33-12131
Approved			
Issued	2-17-75	FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised		Chg Ltr	

Hose Routing, Modulating Valve to Brake Chamber, FMVSS #121

For all suspensions other than Freightliner and Page & Page 750, Wagner modulating valve or Rockwell & Kelsey-Hayes computer & valve assemblies are located in LH frame rail for forward axle of tandem.

Tie hoses together every 8.00 to 12.00 inches after they leave valve, provide slack for axle articulation. Clamp each hose at stud on axle housing and route to RH & LH brake chamber.



FORWARD AXLE OF TANDEM SHOWN

Compiled	F.FREER	SHOP PRACTICE	33-13100
Approved	KRH	WHEELS & TIRES, CONTENTS	
Issued	04/07/65		
Revised	07/21/88	Chg Ltr D FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-38

PRACTICE NO.	DESCRIPTION
33-13101	WHEEL AND TIRE INSTALLATION
33-13102	WHEEL NUT TORQUES
33-13104	TIRE MOUNTING PROCEDURE

COMPILED	WELKER
APPRV	SEEMAN
ISSUE DATE	06/07/85
REV DATE	10/26/92
CHG LTR	F

SHOP PRACTICE
WHEEL AND TIRE INSTALLATION

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-13101

PA2042-30

1. GENERAL

1.1 MOUNTING WHEEL AND TIRE ASSEMBLIES

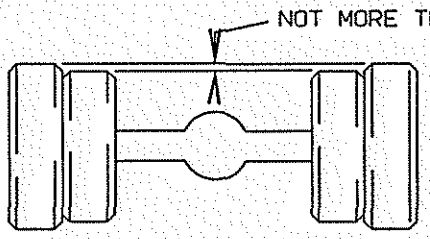
1.1.2 DO NOT LUBRICATE WHEEL MOUNTING THREADS.

1.1.3 BE SURE INNER NUT IS PROPERLY TORQUED BEFORE APPLYING OUTER NUT.

1.1.4 MATCHING DUAL ASSEMBLIES

1.1.4.1 SELECTIVELY MATE ALL DUAL WHEEL AND TIRE ASSEMBLIES IN MATCHED PAIRS. TIRE ASSEMBLIES WHOSE DIAMETER DIFFERS MORE THAN 1/4 INCH MAXIMUM WILL NOT BE MATCHED AS A DUAL PAIR. PROVIDED THE ASSEMBLIES ARE WITHIN TOLERANCE, MOUNT THE SMALL ASSEMBLY ON THE INSIDE - NEXT TO THE CHASSIS.

1.1.4.2 SKETCH



1.2 POSITIONING ASSEMBLIES

1.2.1 MOUNT THE WHEEL AND TIRE ASSEMBLY ON THE CHASSIS WITH THE TIRE BALANCE MARK, IF PRESENT, DIAMETRICALLY(180°) OPPOSITE THE BALANCE WEIGHT ON THE BRAKE DRUM, AS CLOSELY AS POSIBLE, KEEPING THE VALVE STEM IN THE CLEAR. DO NOT ASSEMBLE WITH THE INNER AND OUTER VALVE STEMS LOCATED IN THE SAME WHEEL HAND HOLE.

1.2.1.1 TWO HAND HOLE WHEELS

1.2.1.1.1 MOUNT, AS CLOSELY AS POSIBLE, THE OUTER WHEEL WITH THE VALVE STEM DIRECT OPPOSITE THE VALVE STEM OF THE INNER WHEEL.

1.2.1.2 FIVE HAND HOLE AND ALUMINUM WHEELS

1.2.1.2.1 SEPARATE THE VALVE STEM BY AT LEAST ONE HOLE.

1.3 PERMISSIBLE RUNOUT - ALL ASSEMBLIES

1.3.1 REFER TO ENGINEERING STANDARD 49-00028.

1.4 VALVE STEMS: EATON DILL TR 570, 572, AND 573. ALTERNATE - SCHRADER.

F

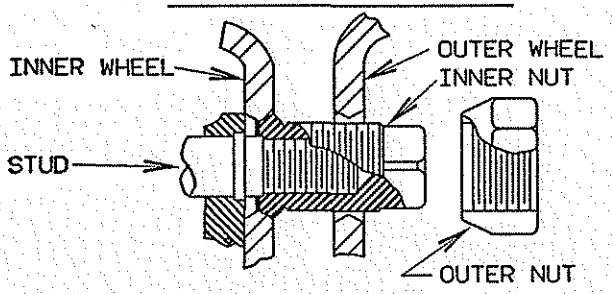
COMPILED	HADDOCK	SHOP PRACTICE WHEEL AND TIRE INSTALLATION	SECTION NUMBER 33-13101
APPRV	HADDOCK		
ISSUE DATE	06/07/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	H		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0013-001 FOR TIRE AND WHEEL INSTALLATION PROCEDURE.

2. DISC WHEEL INSTALLATION

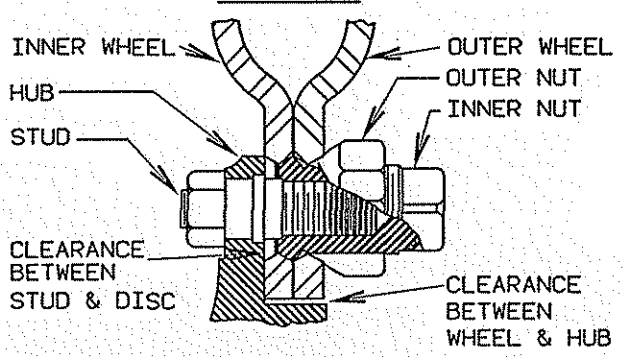
2.1 BALL SEAT MOUNT

IN PROCESS OF ASSEMBLY



NOTE: THE ABOVE SHOWS THE ORDER OF ASSEMBLY. TIGHTEN INNER WHEEL SECURELY TO HUB BEFORE INSTALLING OUTER WHEEL.

ASSEMBLED



WHEEL STUD SIZES:

INNER: 3/4-16 THREAD
OUTER: 1 1/8-16 THREAD

2.1.1 BASIC PRACTICE

2.1.1.1 THE MOUNTING FACES OF THE HUB, THE BALL SEATS AND FLAT MOUNTING SURFACES OF THE WHEELS SHOULD BE CLEAN AND FREE OF FOREIGN MATERIAL OR EXCESS PAINT.

2.1.1.2 THE THREADS OF STUDS AND NUTS SHOULD BE CLEAN AND UNDAMAGED.

2.1.1.3 PERMIT NO OIL OR LUBRICANT OF ANY KIND TO GET IN BALL SEATS OF WHEELS OR ON BALL FACES OF CAP NUTS.

2.1.2. NUT UNIFORMITY

WHEEL NUTS ARE PURCHASED FROM VARIOUS VENDORS UNDER A FREIGHTLINER PART NUMBER. (REF. 13-09072, 13-10001, AND 681 402 00 72) THE FOLLOWING INSTALLATION PROCEDURES ARE TO BE OBSERVED.

2.1.2.1 ALL INNER NUTS ON A WHEEL MUST BE OF THE SAME MANUFACTURER.

2.1.2.2 ALL OUTER NUTS ON A WHEEL MUST BE OF THE SAME MANUFACTURER.

2.1.2.3 INNER AND OUTER NUTS MAY BE OF DIFFERENT MANUFACTURERS.

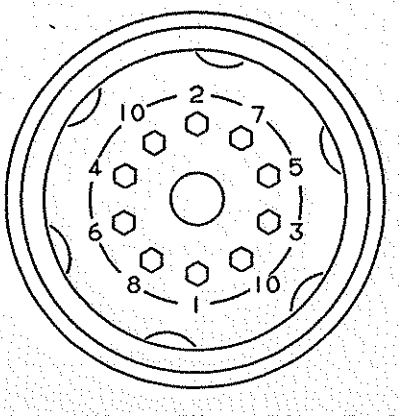
NOTE: THE VENDOR IDENTIFICATION SYMBOLS ARE SHOWN ON THE DRAWINGS REFERENCED ABOVE.

2.1.3 INSTALLATION

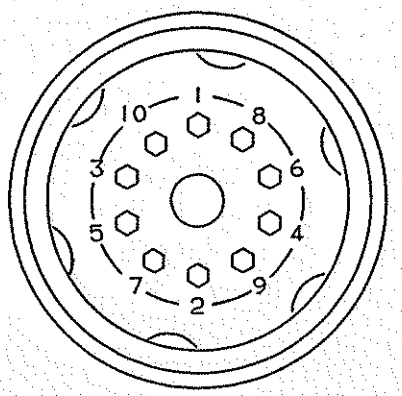
2 1.3.1 INNER DUAL WHEELS ARE MOUNTED FIRST - BY APPLYING TWO INNER CAP NUTS OPPOSITE EACH OTHER AND FIRMLY TIGHTENING BOTH; THEN PROCEED TO TIGHTEN ALL INNER NUTS TO 450 TO 500 FOOT POUNDS OF TORQUE. APPLY THE OUTER CAP NUTS IN THIS SAME MANNER TO THE SAME TORQUE. DRAW UP BOTH INNER AND OUTER NUTS IN THE SEQUENCE SHOWN IN SKETCH ON PAGE 3.

TIGHTENING SEQUENCE PATTERN

INNER DUAL



OUTER DUAL



2.1.3.2 PERIODIC CHECKS WITH A TORQUE WRENCH SHOULD BE MADE TO INSURE ACCURACY OF THE AIR WRENCHES.

3. HUB PILOT MOUNT

3.1 8 NUT HUB PILOTED MOUNTING SYSTEM

A KEY TO THE 8 NUT HUB PILOTED MOUNTING SYSTEM IS PROPER INSTALLATION OF THE TWO PIECE FLANGE NUTS. IT IS IMPORTANT TO FOLLOW THE RECOMMENDED INSTALLATION INSTRUCTIONS, PAYING PARTICULAR ATTENTION TO THE NUT TIGHTENING SEQUENCE.

3.1.1 BEFORE INSTALLING WHEELS, BE SURE THAT THE DRUM IS POSITIONED ON THE RAISED STEP OF THE PILOT PAD. ONE OF THE HUB'S PILOT PADS SHOULD BE AT THE TOP LOCATION. ADJUSTMENT OF THE BRAKES PRIOR TO INSTALLATION OF THE WHEELS HELPS KEEP THE DRUM IN PROPER POSITION.

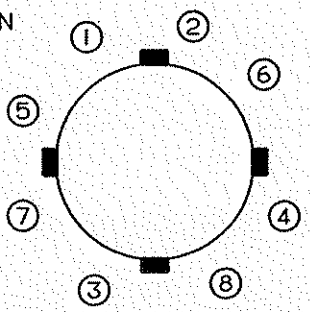
3.1.2 AFTER POSITIONING WHEELS ON PILOT PADS, HAND START THE FLANGED NUTS. ALL NUTS AND STUDS HAVE RIGHT HAND METRIC THREADS.

3.1.3 USING WRENCH WITH STANDARD 1 1/2 INCH HEX SOCKET, SNUG UP TOP NUTS TO ABOUT 50-100 FOOT POUNDS TORQUE. SNUG REMAINING NUTS USING PATTERN SHOWN. STARTING AT THE TOP WILL HELP INSURE THAT THE DRUM AND WHEELS SEAT PROPERLY ON THEIR PILOTS.

3.1.4 CHECK TO BE CERTAIN THAT THE MATING SURFACES OF THE WHEEL(S) AND DRUMS ARE FLUSH.

3.1.5 AGAIN, STARTING WITH THE TOP NUTS, TIGHTEN TO 400-500 FOOT POUNDS USING THE PATTERN SHOWN.

TIGHTENING SEQUENCE PATTERN



3.2 10 NUT HUB PILOTED MOUNTING SYSTEM

3.2.1 WHEEL INSTALLATION

3.2.1.1 CLEAN HUB PILOT BOSSES, WHEEL CENTER HOLES AND DISC MOUNTING FACE.

3.2.1.2 POSITION ONE BOSS AT 12 O'CLOCK.

3.2.1.3 KEEP WHEELS SQUARE TO HUB WHILE INSTALLING.

3.2.1.4 DO NOT DAMAGE STUD THREADS.

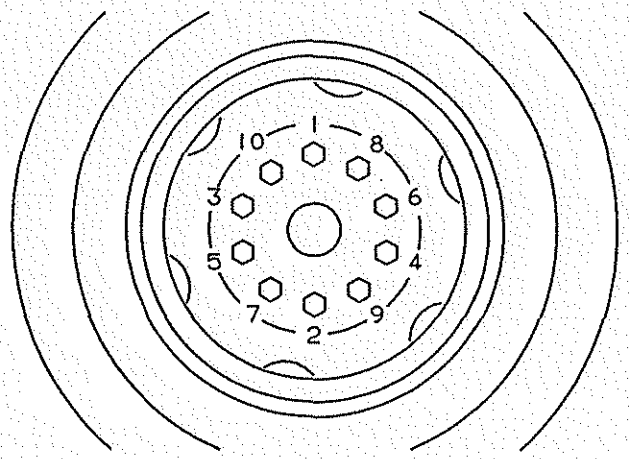
3.2.1.5 HAND TIGHTEN FLANGE NUTS ON TOP AND BOTTOM STUDS.

3.2.2 WHEEL NUT INSTALLATION

3.2.2.1 HAND START REMAINING NUTS.

3.2.2.2 TIGHTEN NUTS TO 50 FOOT POUNDS TORQUE USING CRISSCROSS SEQUENCE PATTERN .

CRISSCROSS TIGHTENING SEQUENCE PATTERN



3.2.2.3 CHECK WHEELS FOR SEATING ON BOSSES. IF MISALIGNED, REMOVE NUTS AND REPOSITION PARTS CORRECTLY.

3.2.2.4 TIGHTEN NUTS TO 400-500 FOOT POUNDS TORQUE USING CRISSCROSS PATTERN.

3.2.3 WHEEL NUT RETORQUING

3.2.3.1 CHECK FOR PROPER TORQUE (400-500 FOOT POUNDS):

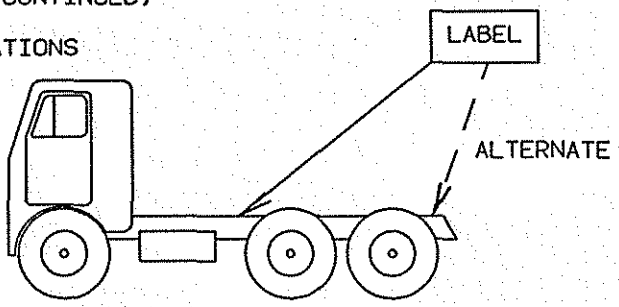
3.2.3.2 DO NOT OVERTORQUE WHEEL NUTS.

3.3 INFORMATION LABEL:

3.3.1 REFER TO SKETCH ON PAGE 5 FOR PREFERRED AND ALTERNATE VENDOR LABEL LOCATIONS.

3.3 INFORMATION LABEL (CONTINUED)

SKETCH: LABEL LOCATIONS



3.3.2 INSTALL ONE LABEL PER RAIL.

3.3.3 LABEL IS TO BE IN SAME POSITION ON BOTH RIGHT AND LEFT RAILS.

3.3.4 TOP EDGE OF LABEL SHOULD BE LEVEL AND 1.50 INCH ±.50 INCH BELOW TOP OF FRAME.

3.3.5 AVOID OBSTRUCTIONS, BOLTS, AND HOLES.

3.3.6 APPLY LABEL AFTER CHASSIS PAINT IS COMPLETELY COOLED.

3.3.7 PEEL OFF SPLIT BACKING AND PRESS HARD, WORKING OUT THE BUBBLES.

4. DEMOUNTABLE RIM INSTALLATION

4.1 PLACE RIMS AND SPACER BAND (REARS) ON WHEEL. SECURE CLAMPS EVENLY IN POSITION AND DRAW UP NUTS ALTERNATELY IN THE SEQUENCE SHOWN BELOW.

4.2 DO NOT TIGHTEN THE NUTS FULLY, RUN THE NUTS DOWN UNTIL THE END OF THE STUD OR RIM BOLT IS FLUSH WITH THE FACE OF THE NUT. THIS PERMITS THE INSIDE RIM TO PROPERLY ALIGN ITSELF ON THE 28° MOUNTING BEVEL ON THE BACK OF THE SPOKE WHEEL, AVOIDING WHEEL WOBBLE.

4.3 THEN, TIGHTEN NUTS FULLY, USING THE SAME ALTERNATE SEQUENCE.

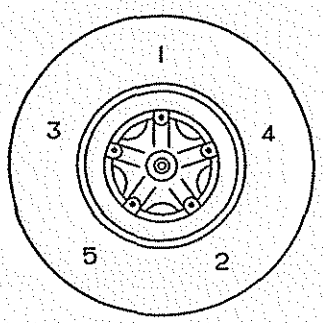
4.3.1 3/4-10 UNF: 210-260 FOOT POUNDS OF TORQUE.

4.3.2 5/8-11 UNF: 150-175 FOOT POUNDS OF TORQUE.

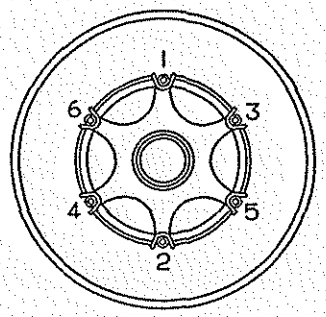
4.3.3 TIGHTEN WITH TWO OR THREE STEP GRADUAL TIGHTENING.

4.4 PERIODIC CHECKS WITH A TORQUE WRENCH SHOULD BE MADE TO INSURE ACCURACY OF THE AIR WRENCHES.

4.5 SKETCH: TIGHTENING SEQUENCE



5 SPOKES



6 SPOKES

Compiled	N.R.	SHOP PRACTICE WHEEL NUT TORQUES	33-13102
Approved	KNUDSON		
Issued	8-2-68		
Revised	3-29-76	Chg Ltr B **FREIGHTLINER CORPORATION** PORTLAND, OREGON	P*A078-21

SPECIAL TORQUE VALUES FOR WHEEL NUT TIGHTENING

WHEEL NUT		WHEEL		TORQUE FT-LB (DRY THREAD)	REMARKS
LOCATION	SIZE THREAD	TYPE	MFR		
Inner	3/4 - 16 UNF	DISC	ALU BUD FI GYR	450-500	(1) (2) (4)
Outer	1 1/8 - 16 UN	DISC	ALU BUD FI GYR	450-500	(1) (2) (4)
B Rim Stud	3/4 - 10 UNF	SPOKE	DTN GUN WWD	200-215	(2) (3) (4)
B	5/8 - 11 UNF	SPOKE	DTN GUN WWD	200-215	(2) (3) (4)
Back-Nuts	3/4 - 16 UNF	DISC	ALU BUD FI GYR	175-200	(4)

1. Be sure inner nut is properly torqued before applying outer nut.
2. Permit no oil or lubricant of any kind to get in ball seats of wheels or on ball faces of cap nuts.
3. Spoke wheel nuts must be tightened as nearly as possible in opposite paired sequence, with two or three step gradual tightening repeatedly across the bolt circle.
4. Torque values are for dry threads. Do not lubricate wheel mounting threads.

A. Revised & Redrawn

COMPILED	HADDOCK	SHOP PRACTICE TIRE MOUNTING PROCEDURE	SECTION NUMBER 33-13104
APPRV	HADDOCK		
ISSUE DATE	07/28/82		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0013-002 FOR TIRE MOUNTING PROCEDURE.

COMPILED	HADDOCK	SHOP PRACTICE TIRE MOUNTING PROCEDURE	SECTION NUMBER 33-13104
APPRV	HADDOCK		PAGE 1 OF 3
ISSUE DATE	07/28/82	FREIGHTLINER CORPORATION PORTLAND, OREGON	P3956J-01
REV DATE	03/27/95		
CHG LTR	D		

1. GENERAL:

1.1 PROPER TIRE MOUNTING IS CRITICAL TO THE ULTIMATE PERFORMANCE OF A TIRE. THE FOLLOWING SHOP PRACTICE MUST BE ADHERED TO INSURE A PROPERLY MOUNTED TIRE.

1.1.1 INSPECT TIRES AND WHEELS FOR PROPER SIZE, LOAD CAPACITY, TYPE (TREAD), MARKING, AND FOR ANY DAMAGE.

1.1.2 TIRES MUST BE CLEAN AND DRY WITH NO VISIBLE MOISTURE INSIDE THE TIRE OR ON THE BEADS OF THE TIRE.

1.1.3 TIRES MUST BE INFLATED WITH THE DRIEST POSSIBLE AIR. AIR SYSTEMS MUST BE EQUIPPED WITH AN ADEQUATE, PROPERLY FUNCTIONING MOISTURE TRAP.

2. TIRE AND RIM LUBRICATION

2.1 ONLY VEGETABLE OIL BASE SOAP SOLUTION TIRE LUBRICANTS ARE TO BE USED.

2.1.1 RECOMMENDED LUBRICANT: "ALCHEM" #1125.

2.1.2 IT IS IMPORTANT THAT THE TIRE LUBRICANT BE CLEAN AND FREE OF DIRT, SAND, METAL SHAVINGS OR OTHER HARD PARTICLES.

2.2 AVOID USING EXCESSIVE AMOUNTS OF LUBRICANTS. USE ONLY ENOUGH LUBRICANT TO COAT THE SURFACES WITHOUT CAUSING RUNS. DO NOT ALLOW THE LUBRICANT TO DRY. COAT THE TIRE IMMEDIATELY PRIOR TO MOUNTING ON THE WHEEL.

2.3 TUBELESS TIRES

2.3.1 LUBRICANT MUST BE APPLIED TO ALL SURFACES OF THE BEAD AREA OF THE TIRE AND TO THE ENTIRE RIM SURFACE FROM FLANGE TO FLANGE. REFER TO FIGURE #A.

2.4 TUBE TYPE TIRES

2.4.1 LUBRICANT MUST BE APPLIED TO ALL SURFACES OF THE BEAD AREA, TO ALL EXPOSED SURFACES OF THE FLAP, AND TO THE BEAD SEAT AREAS OF THE RIM. REFER TO FIGURE #B.

FIGURE A

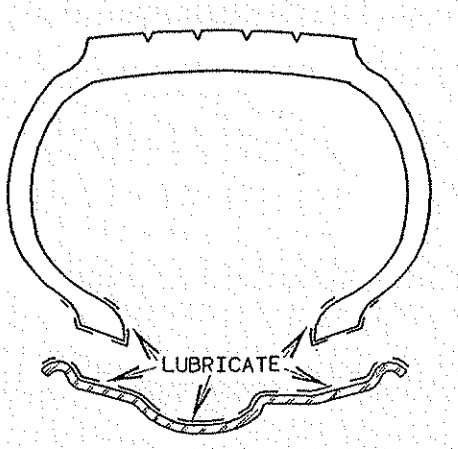
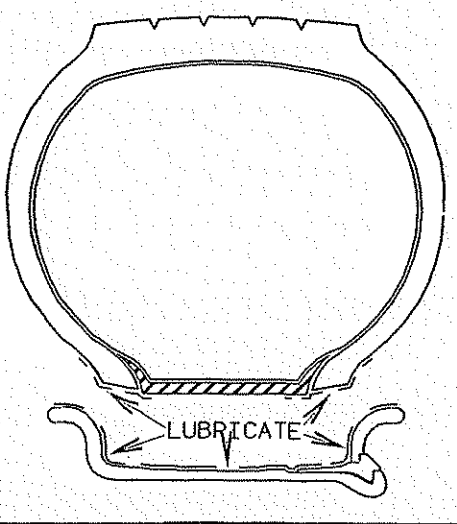


FIGURE B



3. TIRE MOUNTING PROCEDURE

NOTE: WHEEL AND TIRE MATCH MARKS

THE MATCH MARK ON STEEL WHEELS IS A PINNED DIMPLE MARK LOCATED NEAR THE EXTERIOR FLANGE/SEAT AREA OF THE WHEEL.

THE MATCH MARK ON ALUMINUM WHEELS IS THE VALVE STEM OPENING.

THE MATCH MARKS ON TIRES ARE COLORED DOTS OR CIRCLES AS INDICATED IN THE TABLE.

3.1 **TUBELESS** - WITH THE SHORT SIDE UP, AND THE VALVE STEM 180° FROM WHERE THE TIRE BEADS WILL START IN THE DROP CENTER, PLACE THE TIRE ON THE WHEEL WITH THE MATCH MARK SIDE OUT, IN SUCH A MANNER THAT THE MARK WILL BE ALIGNED WITHIN 2 INCHES OF THE WHEEL MARK WHEN MOUNTED.

3.1.1 THE TIRE IS TO BE POSITIONED IN RELATION TO THE WHEEL PRIOR TO MOUNTING AS INDICATED ON THE CHART.

TIRE	TIRE MATCH MARK AND COLOR	ALIGNMENT		
		STEEL WHEELS		ALUM. WHEELS
		WITH MATCH MARK	WITHOUT MATCH MARK	
MICHELIN	WHITE (HIGH POINT) ●	TIRE MATCH MARK TO WHEEL MATCH MARK.	SPECIAL ALIGNMENT NOT NECESSARY.	TIRE MATCH MARK TO VALVE STEM.
BRIDGESTONE	YELLOW (BALANCE MARK) ◉	TIRE MATCH MARK TO VALVE STEM.	TIRE MATCH MARK TO VALVE STEM.	TIRE MATCH MARK TO VALVE STEM.
	RED (HIGH POINT) ● & YELLOW (BALANCE MARK) ◉	RED TIRE MATCH MARK TO WHEEL MATCH MARK.	**DRIVE AXLE USE:** RED TIRE MATCH MARK TO VALVE STEM. **STEER AXLE USE:** YELLOW TIRE MATCH MARK TO VALVE STEM.	RED TIRE MATCH MARK TO VALVE STEM.
GOODYEAR	RED (HIGH POINT) ●	TIRE MATCH MARK TO WHEEL MATCH MARK.	TIRE MATCH MARK TO VALVE STEM.	TIRE MATCH MARK TO VALVE STEM.

D

3.2 **TUBE TYPE** - PLACE TIRE, TUBE AND FLAP ON RIM, TAKING CARE TO CENTER VALVE IN SLOT. FIT SIDE RING AND LOCK RING AND INSURE THAT THEY ARE PROPERLY POSITIONED AND LOCKED.

3.2.1 THE TUBES ARE TO BE CORRECTLY PLACED IN THE TIRE BY THE VENDOR. THE VALVE STEM OF THE TUBE IS TO BE LOCATED WITH RESPECT TO A PREDETERMINED BALANCE MARK ON THE TIRE AS INDICATED ON THE CHART.

3.2.1.1 SHOULD THE TIRE AND TUBE BE MISALIGNED, ALIGN THE ASSEMBLY PRIOR TO MOUNTING ON THE RIM.

4. INFLATION

4.1 TUBELESS

4.1.1 MOUNT BOTH BEADS OF THE TIRE ON THE WHEEL AND INFLATE TO 3 PSI TO BEGIN SEATING THE BEADS.

4.1.2 TIRES MUST BE INFLATED IMMEDIATELY AFTER MOUNTING TO INSURE THAT THE TIRE LUBRICANT HAS NOT DRIED.

4.1.3 PLACE THE ASSEMBLY IN AN OSHA APPROVED INFLATION SAFETY CAGE AND INFLATE TO 100-110 P.S.I., OR TO THE MAXIMUM ON THE SIDEWALL OF THE TIRE, WHICHEVER IS LOWER.

4.1.3.1 PRESSURE SHOULD NEVER EXCEED MAXIMUM TIRE, WHEEL, OR RIM INFLATION RATINGS.

4.1.4 WHEN FULLY INFLATED, CHECK THAT THE SPACING FROM THE LINE UP RING TO THE WHEEL FLANGE IS THE SAME (WITHIN 1/16") ALL AROUND BOTH BEADS.

4.1.4.1 IF NOT, BREAK DOWN BOTH BEADS, RELUBE AND REINFLATE.

4.2 TUBE TYPE

4.2.1 REMOVE VALVE CORE AND WITH TIRE/WHEEL ASSEMBLY IN A SAFETY CAGE, INFLATE TO 100 PSI OR THE MAXIMUM TIRE PRESSURE MOLDED ON THE TIRE SIDEWALL, WHICHEVER IS LOWER, TO SEAT THE BEADS, MAKING SURE ALL RIM COMPONENTS ARE CENTERED AND PROPERLY LOCKED.

4.2.2 TIRES MUST BE INFLATED IMMEDIATELY AFTER MOUNTING TO INSURE THAT THE TIRE LUBRICANT HAS NOT DRIED.

4.2.3 CHECK TO MAKE SURE THE GUIDE RIB ON THE TIRES IS CONCENTRIC TO THE RIM FLANGE.

4.2.3.1 IF NOT CONCENTRIC, THE TIRE MUST BE BROKEN DOWN AND REMOUNTED.

4.2.4 DEFLATE THE TIRE TO ALLOW THE TUBE TO RELAX THUS ELIMINATING ANY WRINKLES THAT MAY HAVE OCCURED DURING THE INITIAL INFLATION.

4.2.5 INSTALL THE VALVE CORE.

4.2.6 WITH THE TIRE/WHEEL ASSEMBLY IN A SAFETY CAGE, INFLATE TO 90-95 PSI OR THE MAXIMUM INFLATION PRESSURE AS MOLDED ON THE TIRE SIDEWALL, WHICHEVER IS LOWER.

Compiled	F.FREER	SHOP PRACTICE STEERING, CONTENTS	33-14100
Approved	DCR		
Issued	02/06/85		
Revised	07/21/88	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-38

PRACTICE NO.	DESCRIPTION
33-14101	GENERAL STEERING CRITERIA
	Fastener Torque Values
33-14102	PITMAN ARM INSTALLATION & REMOVAL
	Pitman Arm to Output Shaft Timing
33-14106	STEERING GEAR INSTALLATION TO CHASSIS
	Pitman Arm Orientation to Frame
33-14108	DRAG LINK INSTALLATION & STEERING GEAR CENTERING
33-14110	POWER STEERING RESERVOIR INSTALLATION CRITERIA
33-14112	INTEGRAL POWER STEERING PLUMBING
33-14114	STEERING COLUMN & UNIVERSAL SHAFT SUB-ASSEMBLY
	Pinch Bolt Installation
	Bearing Support Installation
	Adhesive Application
33-14116	STEERING COLUMN & UNIVERSAL SHAFT INSTALLATION
	Steering Wheel Setting
	Universal Shaft Boot & Intermediate Bearing Support
	Universal Joint Phasing
	Steering Gear Yoke Installation
	Steering Wheel Installation
	Horn Button Installation
33-14118	FINAL STEERING ADJUSTMENTS
	Axle Wheel Cut Adjustments
	King Spoke Adjustments
	Unloading Valve Setting IPS
	Inspection
33-14201	STEERING LUBRICATION
33-14301	STEERING SYSTEM TROUBLESHOOTING

SECTION	DESCRIPTION
33-14101	General Steering Criteria Fastener Torque Values
33-14102	Pitman Arm Installation & Removal Pitman Arm to Output Shaft Timing
33-14106	Steering Gear Installation to Chassis Pitman Arm Orientation to Frame
33-14108	Drag Link Installation & Steering Gear Centering
33-14110	Power Steering Reservoir Installation Criteria
33-14112	Integral Power Steering Plumbing
33-14114	Steering Column & Universal Shaft Sub-Assembly Pinch Bolt Installation Bearing Support Installation Adhesive Application
33-14116	Steering Column & Universal Shaft Installation Steering Wheel Setting Universal Shaft Boot & Intermediate Bearing Support Universal Joint Phasing Steering Gear Yoke Installation Steering Wheel Installation Horn Button Installation
33-14118	Final Steering Adjustments Axle Wheel Cut Adjustments King Spoke Adjustments Unloading Valve Setting IPS Inspection
33-14201	Steering Lubrication
33-14301	Steering System Troubleshooting

COMPILED	OWEN
APPRV	DCR
ISSUE DATE	02/06/85
REV DATE	08/25/95
CHG LTR	F

SHOP PRACTICE
CRITERIA
GENERAL STEERING

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-14101

P2A362-36

THE TOTAL STEERING SYSTEM IS THE OPERATORS CONTROL OF THE VEHICLE AND AS SUCH INVOLVES THE HIGHEST PRODUCT LIABILITY OF THE VEHICLE. WITH THIS IN MIND, THE IMPORTANCE OF FOLLOWING ALL PROCEDURES IDENTIFIED CANNOT BE OVER EMPHASIZED.

EXTREME CARE MUST BE EXERCISED IN ALL PHASES OF THESE PROCEDURES.

NO DEVIATIONS FROM B/M SPECIFICATIONS AND PARTS WILL BE ALLOWED WITHOUT PRODUCT ENGINEERING WRITTEN APPROVAL. THIS INCLUDES HOSES, FASTENERS, AND ANY MATERIAL SPECIFICATIONS. ALL FASTENERS OTHER THAN PROVIDED ON SUB-ASSEMBLIES BY COMPONENT VENDORS WILL BE GRADE 8.

WHEN INSTALLING A CASTLE NUT, TIGHTEN EACH NUT UNTIL PROPER TORQUE IS REACHED AND THEN CONTINUE TO TIGHTEN UNTIL A SLOT IN THE NUT ALIGNS WITH THE HOLE IN THE BALL STUD. DO NOT BACK OFF THE NUT TO INSTALL THE COTTER PIN.

TORQUING OF SCREW FASTENERS.

SPECIAL TORQUE REQUIREMENTS ARE SHOWN AND TABULATED ON PAGES 2 AND 3. GENERAL TORQUE VALUES ARE CONTAINED IN 33-00109 AND ON INDIVIDUAL STEERING INSTALLATION DIAGRAMS.

COMPILED	OWEN
APPRV	DCR
ISSUE DATE	02/06/85
REV DATE	08/25/95
CHG LTR	F

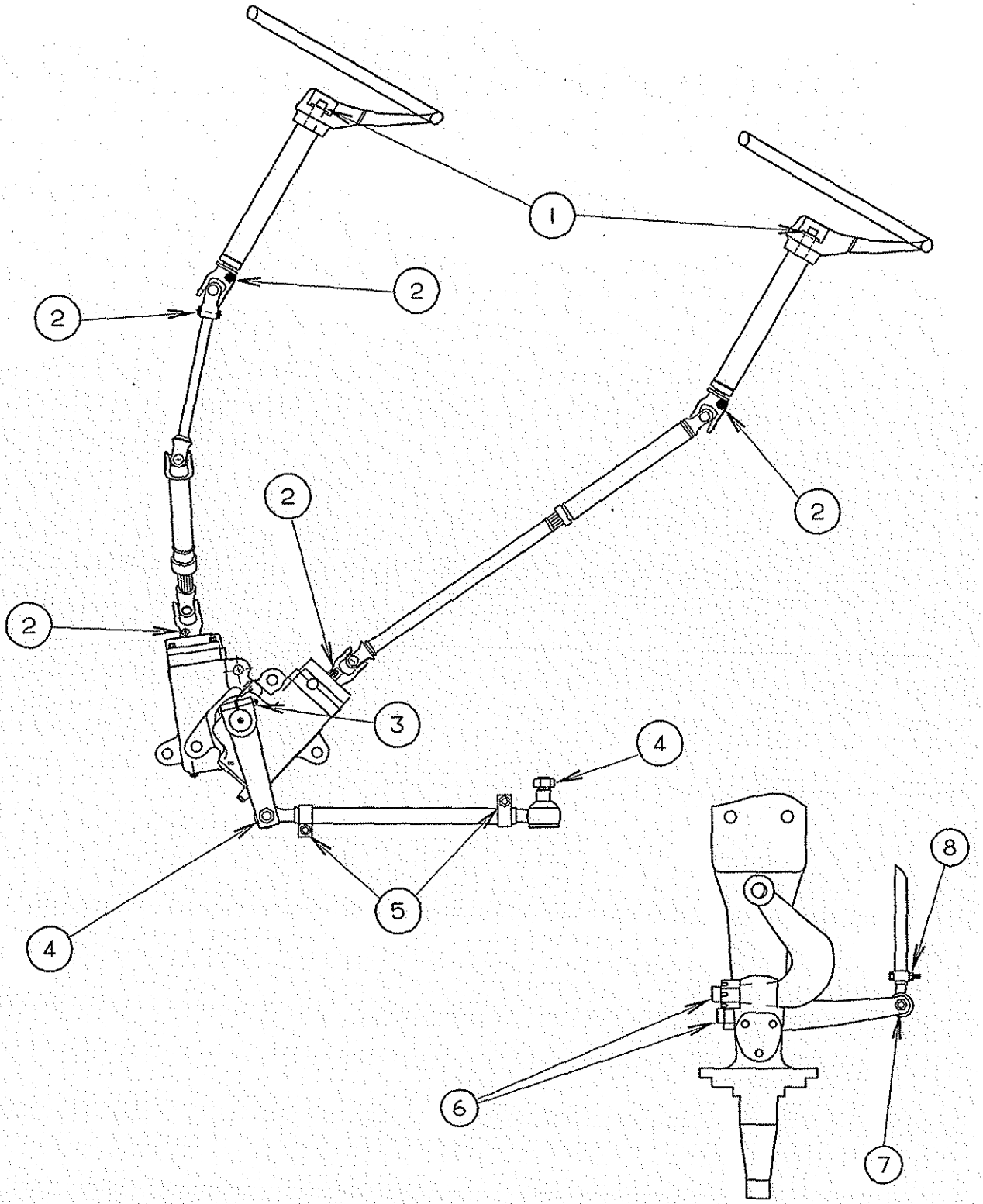
SHOP PRACTICE

CRITERIA
GENERAL STEERING

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-14101

P2A362-36



E

ITEM	DESCRIPTION	SIZE	TORQUE RANGE	
			LB-FT	NM
1	STEERING. WHEEL RETAINING NUT	7/8-18	55-65	75-88
2	U-JOINT PINCH BOLT	3/8-16 3/8-24 7/16-20	35-40 40-48 55-65	47-54 54-65 75-88
3	PITMAN ARM PINCH BOLT	5/8-18 3/4-16	130-155 200-230	177-211 272-313
4	DRAGLINK BOLT STUD NUT TO PITMAN ARM OR STEERING ARM	5/8-18 3/4-16 7/8-14	60-115 90-170 160-300	81-156 122-230 217-407
5	DRAGLINK PINCH BOLT	5/8-11 5/8-18	50-60 50-60	75-81 75-81
6	STEERING ARM TO KNUCKLE NUT TIE ROD TO KNUCKLE NUT	7/8-14 1-14 1 1/8-12 1 1/4-12	250-450 390-725 550-1025 775-1450	339-610 529-983 746-1390 1051-1966
7	TIE ROD ARM TO TIE ROD STUD NUTS	7/8-14 1-14 1 1/8-12 1 1/4-12	160-300 250-450 350-650 500-675	217-4070 339-610 474-881 678-915
8	TIE ROD PINCH BOLT	5/8-11 5/8-18 3/4-10	40-60 40-60 155-175	55-81 55-81 211-237

COMPILED	OWEN
APPRV	D C R
ISSUE DATE	02/06/85
REV DATE	07/29/96
CHG LTR	C

SHOP PRACTICE

PITMAN ARM INSTALLATION COE AND CONVENTIONAL

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-14102
PAGE 1 OF 1
PA2042-72

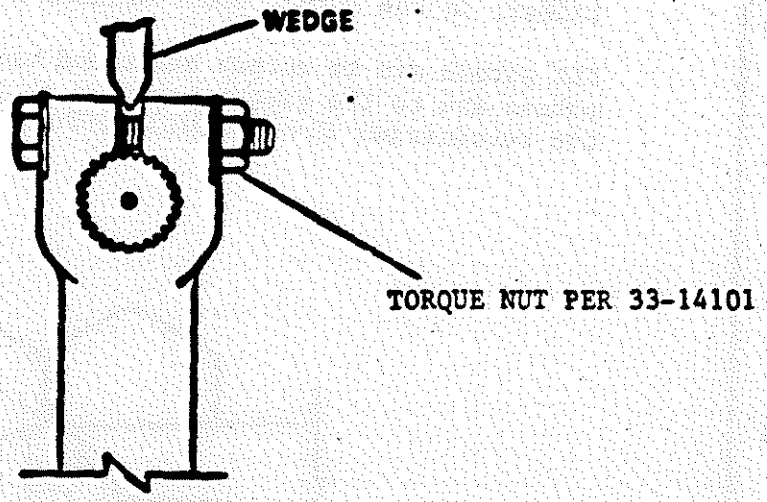
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0014-001 FOR PITMAN ARM INSTALATION, COE AND CONVENTIONAL PROCEDURE.

Compiled	OWEN	SHOP PRACTICE	
Approved	DCR	PITMAN ARM INSTALLATION	33-14102
Issued	2-6-85	COE AND CONVENTIONAL	
Revised	12-14-87	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

B

A. PITMAN ARM INSTALLATION, ROSS STEERING GEARS

Ross TAS 65 RCB 64, HFB 70, and 503 Manual



1. Pitman arms are furnished with a wedge in the clamp slot to facilitate installation on the output shaft. Remove the wedge after positioning the arm.

2. The pitman arm in secured to the output shaft on Ross gears by means of a pinch bolt arrangement. Use only bolts as specified in B/M.

B. PITMAN ARM REMOVAL, ROSS STEERING GEARS

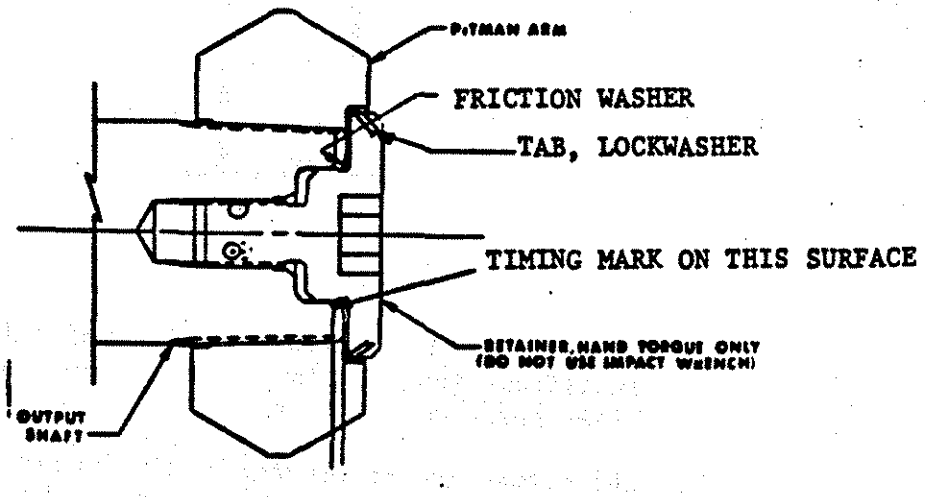
To remove pitman arm, remove bolt and nut, drive a suitable wedge between the ears, and gently tap the arm off. DO NOT HEAT OR USE EXCESSIVE FORCE. A SUITABLE PULLER IS ALLOWABLE.

C. PITMAN ARM INSTALLATION, SHEPPARD POWER STEERING

Sheppard pitman arms are retained to the output shaft by a special retainer which is furnished as part of the steering gear.

Use Lok. Cease, Never Seez or white lead between pitman arm and retainer; in the output shaft threads and on the retainer.

Fit pitman arm to output shaft and use the retainer to push the pitman arm to the proper position on the output shaft. HAND TIGHTEN the retainer per D14-10205/D14-10206. DO NOT USE AN IMPACT WRENCH.



D. PITMAN ARM REMOVAL, SHEPPARD POWER STEERING

To remove pitman arm, remove retainer assembly and use a suitable two or three jaw puller. DO NOT HEAT OR HAMMER; DO NOT USE PRY BAR.

E. PITMAN ARM TO OUTPUT SHAFT TIMING

1. General: Timing marks are provided on the pitman arm and on the steering gear output shaft in all cases. These marks are a reference for initial installation.

   See individual installation diagrams from B/M and 33-14106 for proper in vehicle pitman arm position.

   Note that with exception of manual gears, the specified position of pitman arm with correctly aligned timing marks does not necessarily "center" the steering gear when the vehicle is pointed straight ahead.

A - SEE PAGE 2

Compiled	OWEN	SHOP PRACTICE	
Approved	DCR	STEERING GEAR INSTALLATION	
Issued	3-11-87	TO CHASSIS	33-14106
Revised	12-14-87	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

A. MANUAL STEERING GEARS

Manual steering gears are mounted on brackets attached to the frame assembly. No sub-assembly of gear and bracket is required.

Use only Grade 8 fasteners as specified in the Parts Book. Torque all fasteners as shown on individual installation diagram (Ref. 33-14101). Under no circumstances is a hole through more than one part on either side of the vehicle to be without a fastener when installation is completed.

B. INTEGRAL POWER STEERING GEARS

All integral power steering gears are direct mounting type. No sub-assembly is required.

Use only Grade 8 fasteners as specified in the Parts Book. Torque all fasteners as shown on individual installation diagrams (Ref. 33-14101). Under no circumstances is a hole through more than one part on either side of the vehicle to be without a fastener when installation is complete.

REMOVE & DESTROY

Compiled	OWEN	SHOP PRACTICE	
Approved	DCR	STEERING GEAR INSTALLATION	
Issued	3-11-87	TO CHASSIS	33-14106
Revised	12-14-87 Chg Ltr B	FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

A. MANUAL STEERING GEARS

Manual steering gears are mounted on brackets attached to the frame assembly. No sub-assembly of gear and bracket is required.

Use only Grade 8 fasteners as specified in the Parts Book. Torque all fasteners as shown on individual installation diagram (Ref. 33-14101). Under no circumstances is a hole through more than one part on either side of the vehicle to be without a fastener when installation is completed.

B. INTEGRAL POWER STEERING GEARS

All integral power steering gears are of the direct mounting type. No sub-assembly is required.

Use only Grade 8 fasteners as specified in the Parts Book. Torque all fasteners as shown on individual installation diagrams (Ref. 33-14101). Under no circumstances is a hole through more than one part on either side of the vehicle to remain without a fastener when installation is complete.

B

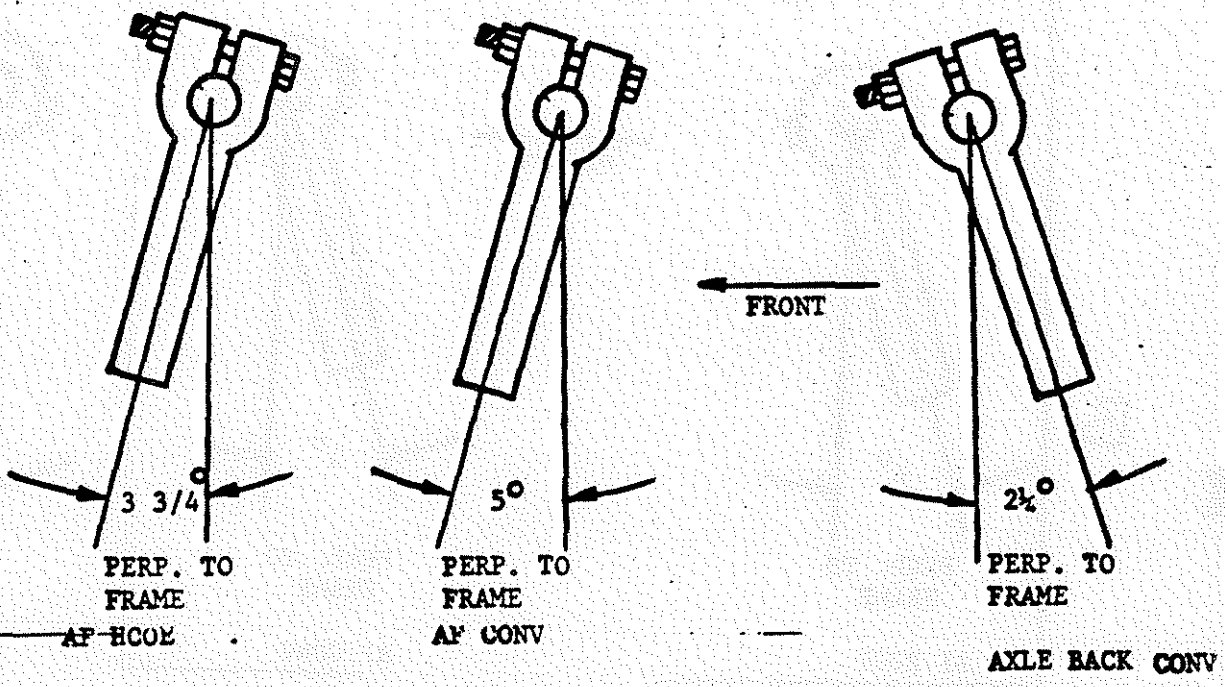
C. STEERING GEAR & PITMAN ARM ORIENTATION

Individual installation diagrams are provided for each steering gear and vehicle configuration. These diagrams are listed in the Steering Gear Inst. B/M (Spec Line 536), specified for each vehicle, and take precedence over the following reference data should there be any difference between Shop Practice and B/M.

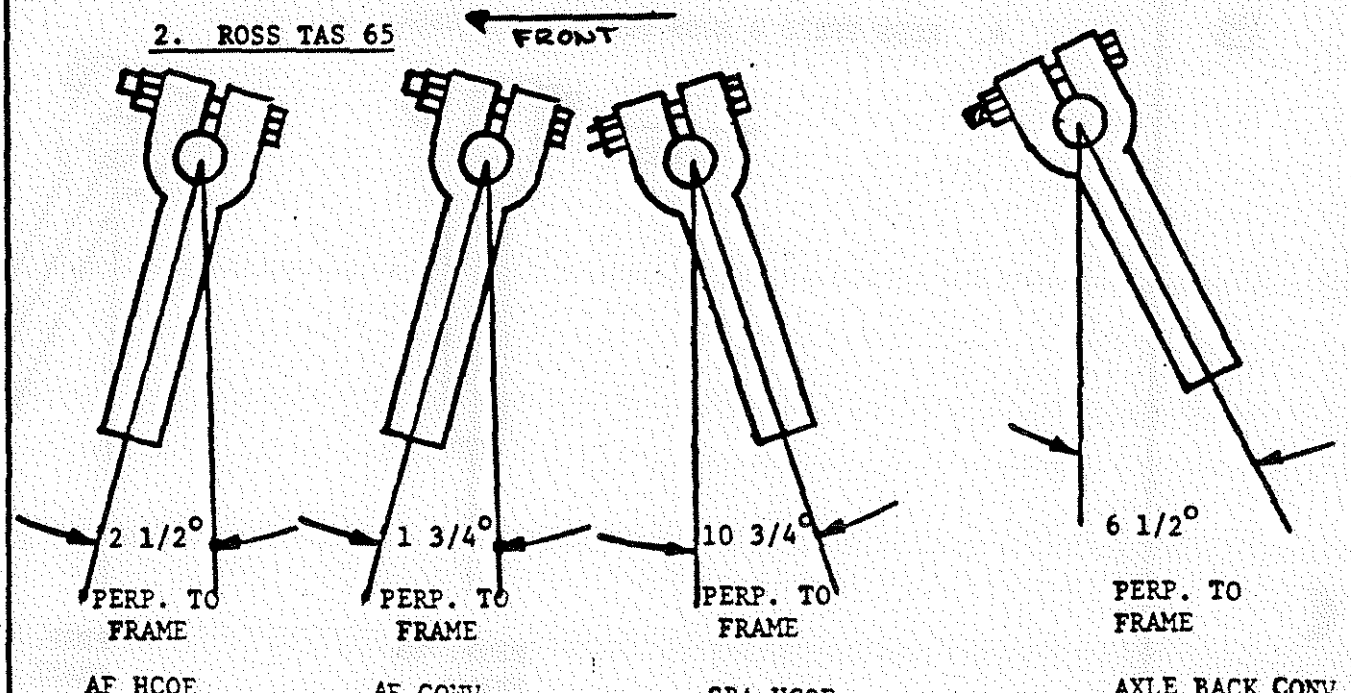
STEERING GEAR	CHASSIS TYPE	GEAR INST DIAG	LINKAGE INST DIAG	PITMAN ARM	DRAGLINK
MANUAL	AF HCOE	D14-10361-0	D14-12008-0	14-10124-0	14-09525-0
	AF CONV	D14-10373-0	D14-12008-1	14-10124-0	14-09525-0
	SBA HCOE	N/A	N/A	N/A	N/A
	SBA CONV	D14-10373-0	D14-12008-2	14-10124-1	14-09525-1
ROSS TAS 65 (Single Gear)	AF HCOE	D14-10363-0,-1	D14-10368-0	14-10282-0	14-10281-0
	AF CONV	D14-10364-0	D14-10368-1	14-10282-0	14-10281-0
	SBA HCOE	D14-10363-0,-1	D14-10368-3	14-10099-4	14-10281-3
	SBA CONV	D14-10364-1,-2	D14-10368-2	14-12007-0	14-10281-4
ROSS TAS 65 (Dual Gear)(LH)	AF HCOE	D14-10363-1	D14-12008-6	14-10099-3	14-09535-0
	AF CONV	D14-10364-0	D14-12008-7	14-10099-2	14-09535-0
	SBA HCOE	N/A	N/A	N/A	N/A
	SBA CONV	D14-10364-2	D14-12008-8	14-10099-1	14-09535-1
ROSS RCB 64 (Dual Gear)(RH)	AF HCOE	D14-10370-0	D14-12008-9	14-10099-3	14-09535-0
	AF CONV	D14-10370-0	D14-12008-9	14-10099-3	14-09535-0
	SBA HCOE	N/A	N/A	N/A	N/A
	SBA CONV	D14-10370-1	D14-12008-10	14-10099-2	14-09535-1
ROSS HFB 70	AF HCOE	D14-10371-0,-1	D14-12008-3	14-10123-0	14-09535-0
	AF CONV	D14-10372-0	D14-12008-4	14-10123-0	14-09535-0
	SBA HCOE	N/A	N/A	N/A	N/A
	SBA CONV	D14-10372-1,-2	D14-12008-5	14-10123-1	14-09535-1
SHEPPARD M100	AF HCOE	D14-10365-0,-1	D14-10369-0	14-10293-0	14-10299-1
	AF CONV	D14-10366-0	D14-10369-1	14-10293-0	14-10299-1
	SBA HCOE	D14-10365-0,-1	D14-10369-3		
	SBA CONV	D14-10366-1,-2	D14-10369-2	14-10293-1	14-10281-2

C. STEERING GEAR & PITMAN ARM ORIENTATION (CONTINUED)

1. MANUAL



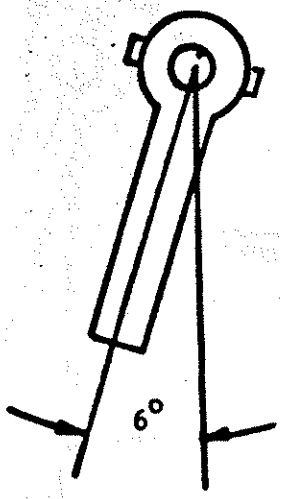
2. ROSS TAS 65



B

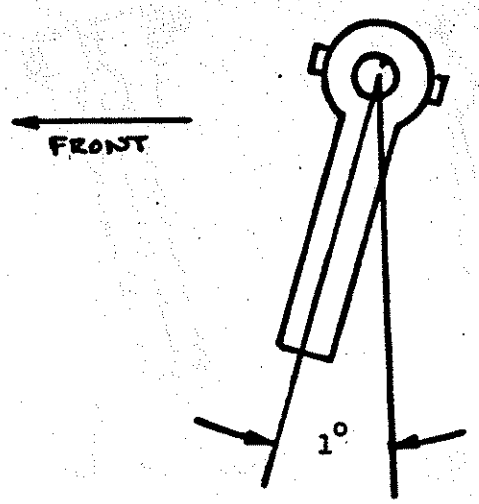
C. STEERING GEAR & PITMAN ARM ORIENTATION (CONTINUED)

3. SHEPPARD M100



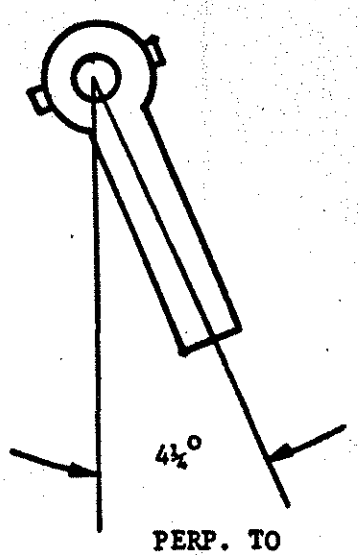
PERP. TO FRAME

AF HCOE



PERP. TO FRAME

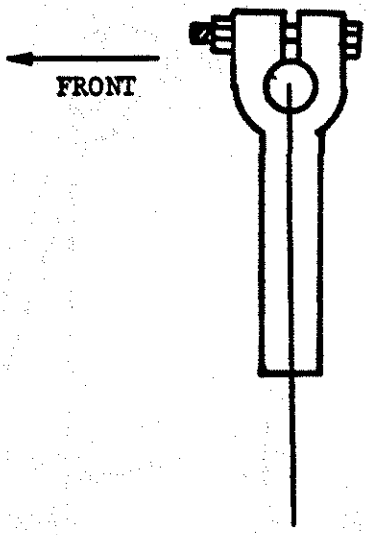
AF CONV



PERP. TO FRAME

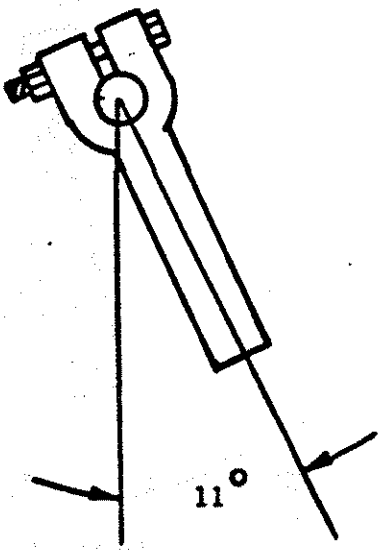
AXLE BACK CONV

4. ROSS HFB70 & ROSS DUAL TAS65/RCB64



PERP. TO FRAME

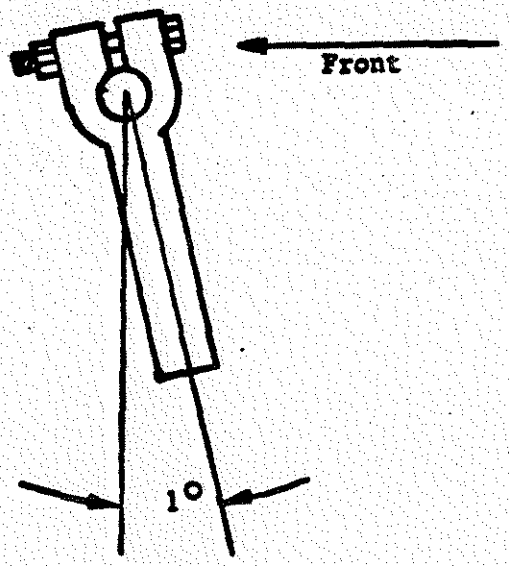
AF CONV



PERP. TO FRAME

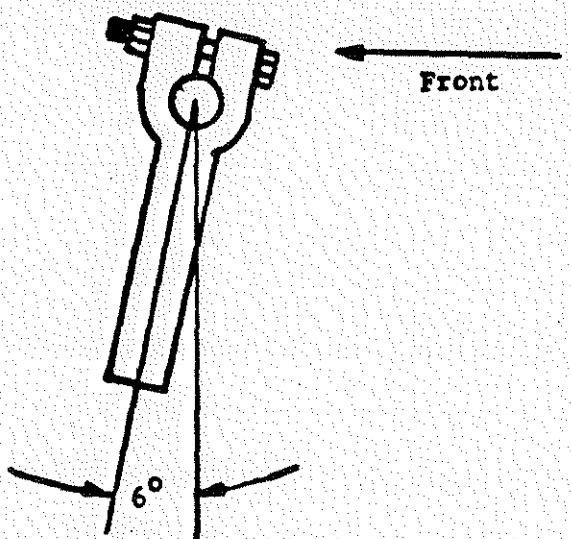
AXLE BACK CONV

4. Continued

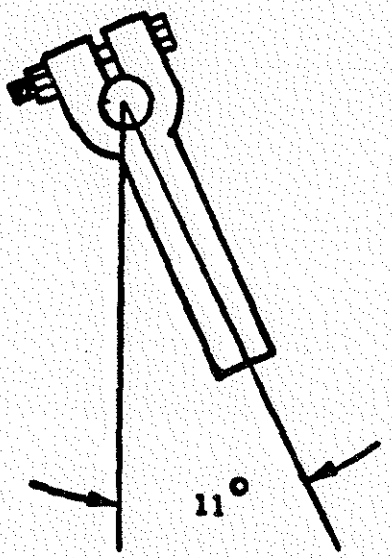


PERP. TO FRAME

AF HCOE, HFB70



PERP. TO FRAME
AF HCOE, TAS65/RCB64,
Left Side



PERP. TO FRAME
AF HCOE, TAS65/RCB64
Right Side

B

COMPILED	OWEN
APPRV	D C R
ISSUE DATE	02/06/85
REV DATE	07/29/96
CHG LTR	C

SHOP PRACTICE

DRAG LINK INSTALLATION AND STEERING GEAR CENTERING

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-14108

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0014-002 FOR DRAG LINK INSTALLATION AND STEERING GEAR CENTERING.

Compiled	OWEN	SHOP PRACTICE DRAG LINK INSTALLATION AND STEERING GEAR CENTERING	33-14108
Approved	DCR		
Issued	2-6-84		
Revised	12-14-87 Chg Ltr B	FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

B

A.1 ADJUSTABLE DRAG LINK INSTALLATION

Manual steering, HFB 70 steering, and Dual TAS 65/RCB 64 steering systems are equipped with straight drag links that are adjustable at both ends and can be installed with either end forward.

Adjustment is provided to compensate for manufacturing and assembly tolerance build up and allow the pitman arm to be positioned as shown on the individual installation digrams when vehicle wheels are straight ahead. Drag link adjustment is not intended to be a king spoke alignment device; see 33-14118. Equal thread engagement is required at both ends after adjustments are made. Minimum thread engagement for socket to tube connections is:

B

DRAG LINK	MIN. ENGAGEMENT
A14-9525	1 3/4"
A14-10294	1 3/4"
A14-9535	2"
A14-10131	1 3/4"

Drag link ball studs are tapered and equipped with slotted nuts for cotter pins. Using no washer, tighten the nut to 100 lb. ft. to seat the taper and then continue tightening only until the cotter pin hole and nut slots will allow insertion of the cotter pin. DO NOT BACK OFF THE NUT TO ALIGN COTTER PIN HOLE.

Drag link pinch clamps must be positioned to prevent interference with steering or vehicle components. The most likely interference points are between clamp and pitman arm in full left hand turn and between clamp and axle in partial right hand turn.

Ball stud sockets are to be 90° from each other. Prior to tightening the pinch clamps, the ball stud sockets must be aligned for adequate articulation. Rotate both sockets in the same direction until they stop against their ball studs. Tighten the pinch bolts.

B

A.2 NONADJUSTABLE DRAG LINK INSTALLATION

M100 and single TAS 65 steering systems are equipped with nonadjustable drag links.

B

Drag link ball studs are tapered and equipped with slotted nuts for cotter pins. Using no washer, tighten the nut to 100 lb. ft. to seat the taper and then continue tightening only until the cotter pin hole and nut slots will allow insertion of the cotter pin. DO NOT BACK OFF THE NUT TO ALIGN COTTER PIN HOLE.

B. STEERING GEAR CENTERING

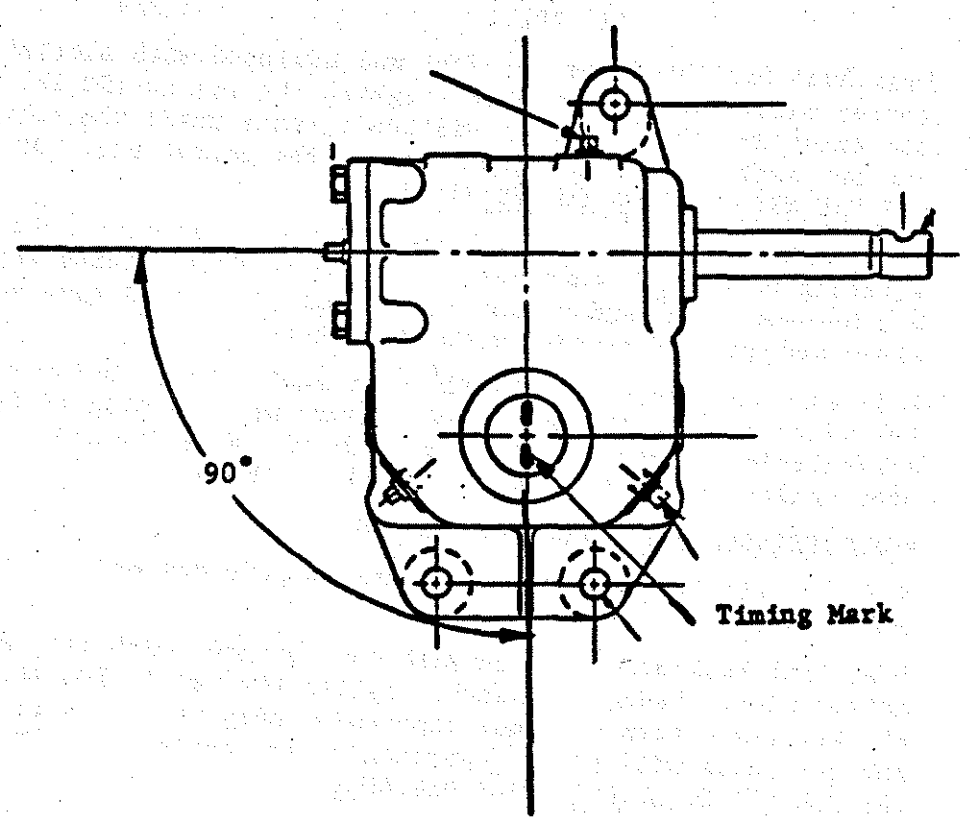
The center position of all steering gears is indicated by a timing mark on the end of the steering gear output shaft. Steering gears are "centered" when the timing mark is perpendicular to the input shaft as shown in Figure 1, on Page 2.

Manual gears must be centered when the vehicle is moving straight ahead.

Ross Power Steering Gears should be centered within 6° when the vehicle is moving straight ahead.

Sheppard Power Steering Gears have no centering requirement.

FIGURE 1



A - SEE PAGE 1

COMPILED	OWEN
APPRV	D C R
ISSUE DATE	02/06/85
REV DATE	07/29/96
CHG LTR	D

SHOP PRACTICE

POWER STEERING RESERVOIR INSTALLATION CRITERIA

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-14110

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0014-003 FOR POWER STEERING RESERVOIR INSTALLATION CRITERIA.

Compiled	OWEN	SHOP PRACTICE POWER STEERING RESERVOIR INSTALLATION CRITERIA	33-14110
Approved	D.C.R.		
Issued	2-6-85		
Revised	9-4-87	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

A. INTEGRAL POWER STEERING RESERVOIR

a. The pump supply hose is to be of sufficient length to allow bends as generous as possible, with a maximum length of 48" unless the reservoir outlet is at least 18" above the pump inlet.

b. All inlet line fittings must be air tight.

c. Hoses are to be routed per 33-14112, Item B, 2.

d. As line restrictions are critical to pump performance, any routing abnormalities are to be cleared with Product Engineering.

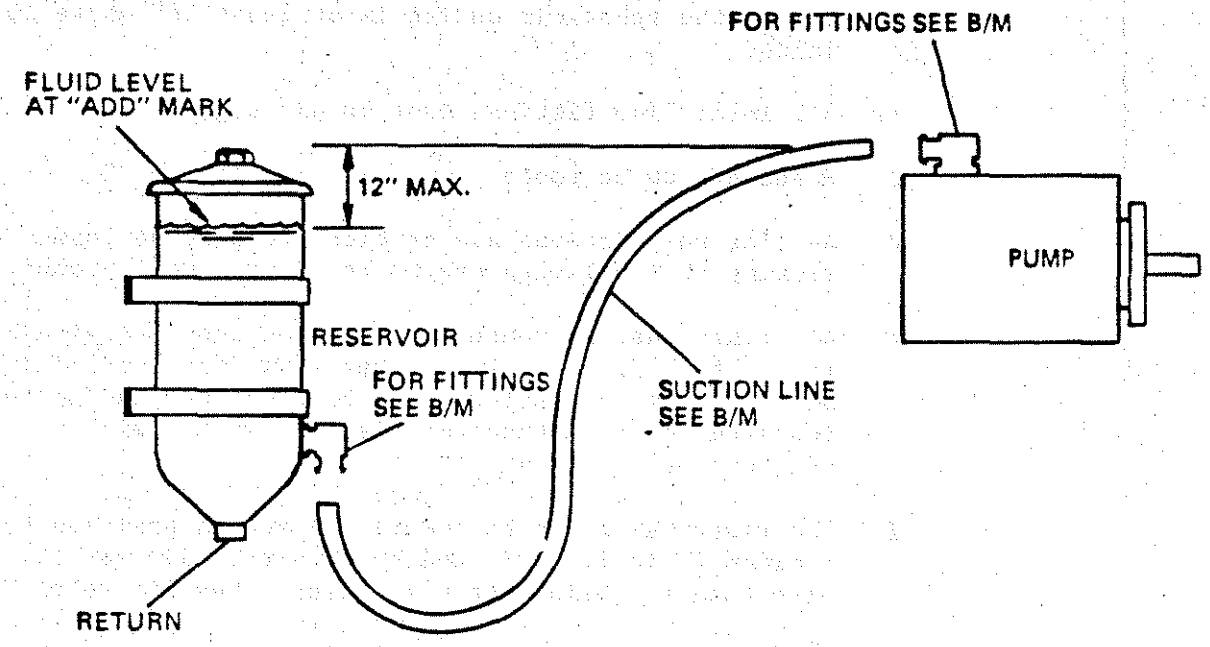
e. All lines must be routed so that routinely serviceable components (i.e., fuel filters, fuel water separators, oil filters, air cleaners, dip sticks, and belt drives) can be readily accessed for adjustment or element removal without the need to relocate or remove any lines.

f. The reservoir is to be located in such a position that the minimum fluid level in the reservoir ("add" mark) is never more than 12" below the pump inlet. See figure on Page 2.

g. After system bleeding, the fluid level is to be checked when cold. Level is to be within .500" of the "Full" mark but not over "Full".

NOTE: "Add" mark is 1.75 inches below the fill cap.

A. INTEGRAL POWER STEERING RESERVOIR, CONT.



COMPILED	OWEN	SHOP PRACTICE PLUMBING POWER STEERING	SECTION NUMBER 33-14112
APPRV	DCR		
ISSUE DATE	12/14/87		PAGE 1 OF 1
REV DATE	03/17/94	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		P1537D-01

POWER STEERING HOSE AND ROUTING

1. POWER STEERING HOSE ROUTINGS, WHILE GENERALLY AT SHOP DISCRETION, DUE TO VARIATIONS INVOLVED, MUST MEET THE FOLLOWING CRITERIA:

1.1 FITTINGS AND HOSES SPECIFIED IN THE B/M'S ARE NOT TO BE DEVIATED FROM WITHOUT WRITTEN PRODUCT ENGINEERING APPROVAL. HOSE LENGTHS ARE AT THE SHOP'S DISCRETION.

1.2 HOSES ARE TO BE ROUTED IN THE SHORTEST PATH POSSIBLE WITHOUT KINKS OR SEVERE BENDS. THE MINIMUM BEND RADII ARE:

DESCRIPTION	HOSE SIZE	MIN BEND RADIUS (IN)
RETURN LINE	8	5.00
PRESSURE LINE	8	5.00
SUPPLY LINE	12	5.00
	16	6.00

1.3 HOSES ROUTED NEAR MOVING COMPONENTS MUST BE EFFECTIVELY CLAMPED TO KEEP A MINIMUM OF .50" CLEARANCE IN THE EXTREME LIMITS OF MOVEMENT AND SUCH THAT THE HOSE ITSELF HAS A MINIMAL POSSIBILITY OF MOVEMENT.

1.4 HOSES ROUTED WITHIN 6.00" OF MANIFOLDS AND SUCH HOT COMPONENTS MUST BE PROVIDED WITH HEAT SHIELDS.

1.5 PIPE THREAD SEALANT (48-00094-108)IS TO BE APPLIED TO THE THREADS OF ALL PIPE FITTINGS IF THEY DO NOT HAVE VENDOR PRE-APPLIED PIPE THREAD SEALANT.

COMPILED	OWEN	SHOP PRACTICE STEERING COLUMN & UNIVERSAL SHAFT SUB-ASSEMBLY	SECTION NUMBER 33-14114
APPRV	D C R		
ISSUE DATE	02/06/85		PAGE 1 OF 1
REV DATE	07/30/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	F		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0014-004 FOR STEERING COLUMN AND UNIVERSAL SHAFT SUB-ASSEMBLY.

A. UPPER COLUMN AND UNIVERSAL SHAFT SUB-ASSEMBLY

The steering column, universal shaft, and steering wheel are sub-assembled prior to installation in the vehicle. The universal shaft yokes are all either welded or secured with pinch bolts and Loctite. The steering wheel is not permanently installed at this time.

WARNING: All U-joint pinch bolts are torqued and serrated joints secured with Loctite during their sub-assembly. All attaching U-joints, except the steering column to universal shaft connection, are of the whistle-notch bolt type and can be assembled in one position only.

Warning, U-joint Driveline Selection

The lower steering driveline joint at the gear has two different spline sizes and special care must be exercised to be sure the correct joint for the particular gear is used. This applies to all vehicle.

Ross Manual Gears	1"-36	Spline
Sheppard M100 I.P.S. Gears	1"-36	Spline
Ross TAS 65 IPS Gears	13/16"-36	Spline
Ross HFB 70 IPS Gears	13/16"-36	Spline

B. PINCH BOLT INSTALLATION (REF. FIGURE 1, PAGE 4)

Upper: The upper pinch bolt is at the joint which connects the universal shaft to the steering column. This pinch bolt is the same on all Freightliner vehicles, a 3/8-16 UNC, Grade 8, yellow colored flange bolt (14-9683-0) with flange nut (23-11020-6) and must be torqued to 35-40 lb. - ft.

Lower: The lower pinch bolt is at the joint which connects the universal shaft to the steering gear input shaft. This pinch bolt is not installed as part of the sub-assembly.

Intermediate: The intermediate pinch bolt is used only on COEs and is in the lower yoke of the U-joint just below the upper steering column. The fastener is a 7/16-20 UNF, Grade 8, hex head bolt supplied by the universal shaft vendor already tightened to the required 63-75 lb. - ft.

C. BEARING SUPPORT INSTALLATION (REF. FIGURE 2, PAGE 5)

The bearing support, used in COE vehicles only, is installed on the intermediate bearing supplied with the universal shaft without dis-assembling the universal shaft.

Seal the split support with non-hardening gap & hole filler (48-00094-601).

D. ADHESIVE APPLICATION

Adhesive must be applied to the serrations of all Freightliner assembled joints* in the steering driveline system on ALL vehicles per the following instructions:

1. Wipe the steering serrated shaft with a rag to remove any grease. Any paint on the shafts must also be removed.

2. Apply an approved primer to the shaft and allow to dry.

3. Apply a bead of adhesive to the bottom of the yoke serrations and complete the assembly.

4. Prior to torquing, be sure the yoke hole is properly aligned with steering chuck input shaft groove or whistle notch. The pinch bolt should slip in and out with ease.

5. Install the pinch bolt and nut, and torque as specified. Ref. 33-14101, pg. 2

   NOTE: Once the yoke has been assembled to the shaft, the pinch bolt must be torqued within four minutes. If this time is exceeded, the parts must be cleaned and retreated.

6. After torquing, apply green color Torque Seal F-900** to the exposed bolt threads and nut tip.

7. Wipe off any excess adhesive.

8. Identify the assembly by applying red paint to the yoke.

9. Approved Adhesives and Primer (No Substitutes)

   Loctite #680 with Loquic General Purpose Primer T.

* The intermediate joint on COEs comes preassembled with adhesive from the vendor. If this joint has been dis-assembled for any reason, adhesive must be used during re-assembly.

** Manufactured by Organic Products Co.
P.O. Box 428
Irving, Texas 75060

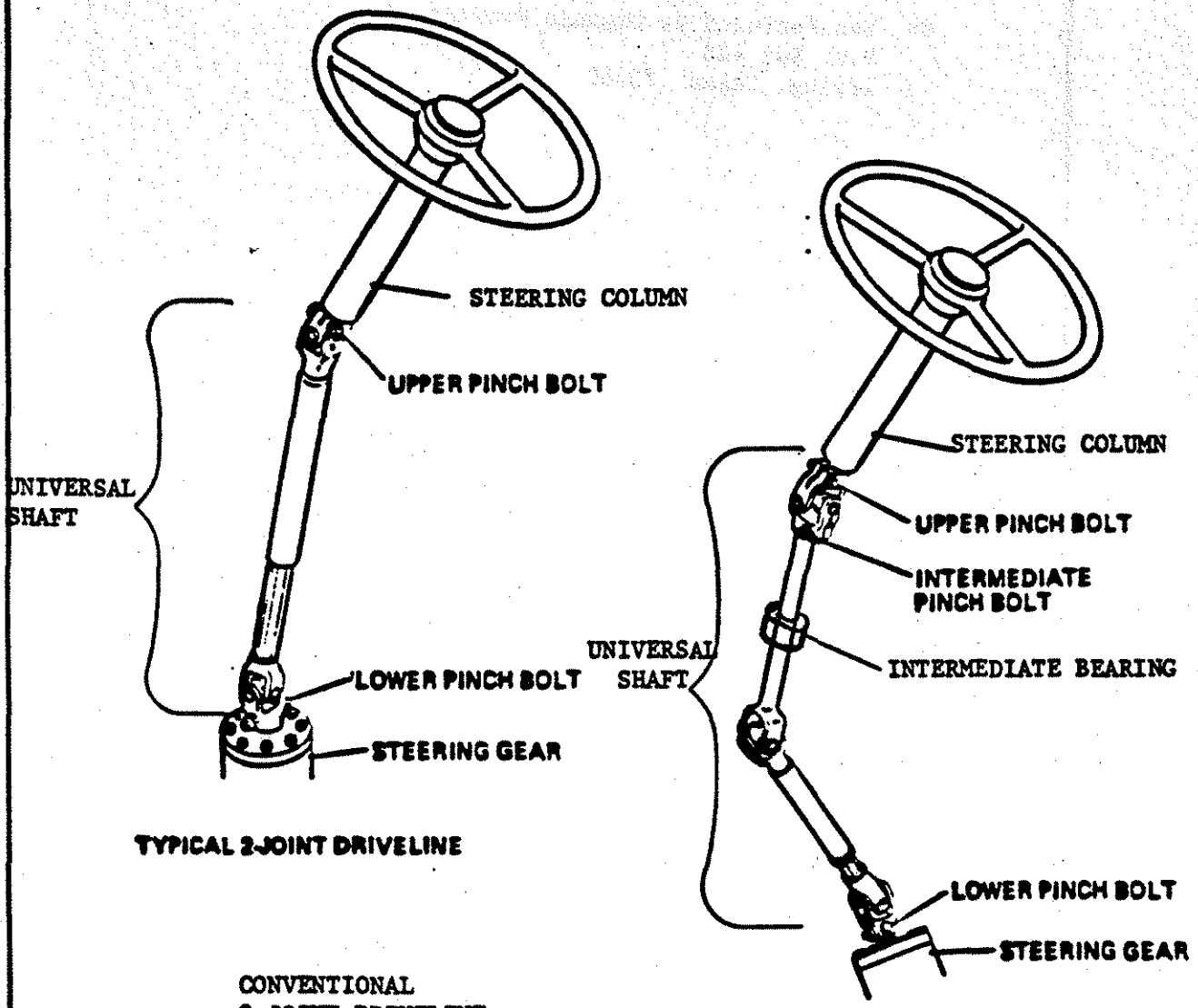

STEERING COLUMN
UPPER PINCH BOLT
UNIVERSAL SHAFT
LOWER PINCH BOLT
STEERING GEAR
TYPICAL 2-JOINT DRIVELINE
CONVENTIONAL
2 JOINT DRIVELINE
STEERING COLUMN
UPPER PINCH BOLT
INTERMEDIATE PINCH BOLT
UNIVERSAL SHAFT
INTERMEDIATE BEARING
LOWER PINCH BOLT
STEERING GEAR
COE
3 JOINT DRIVELINE

Figure 1

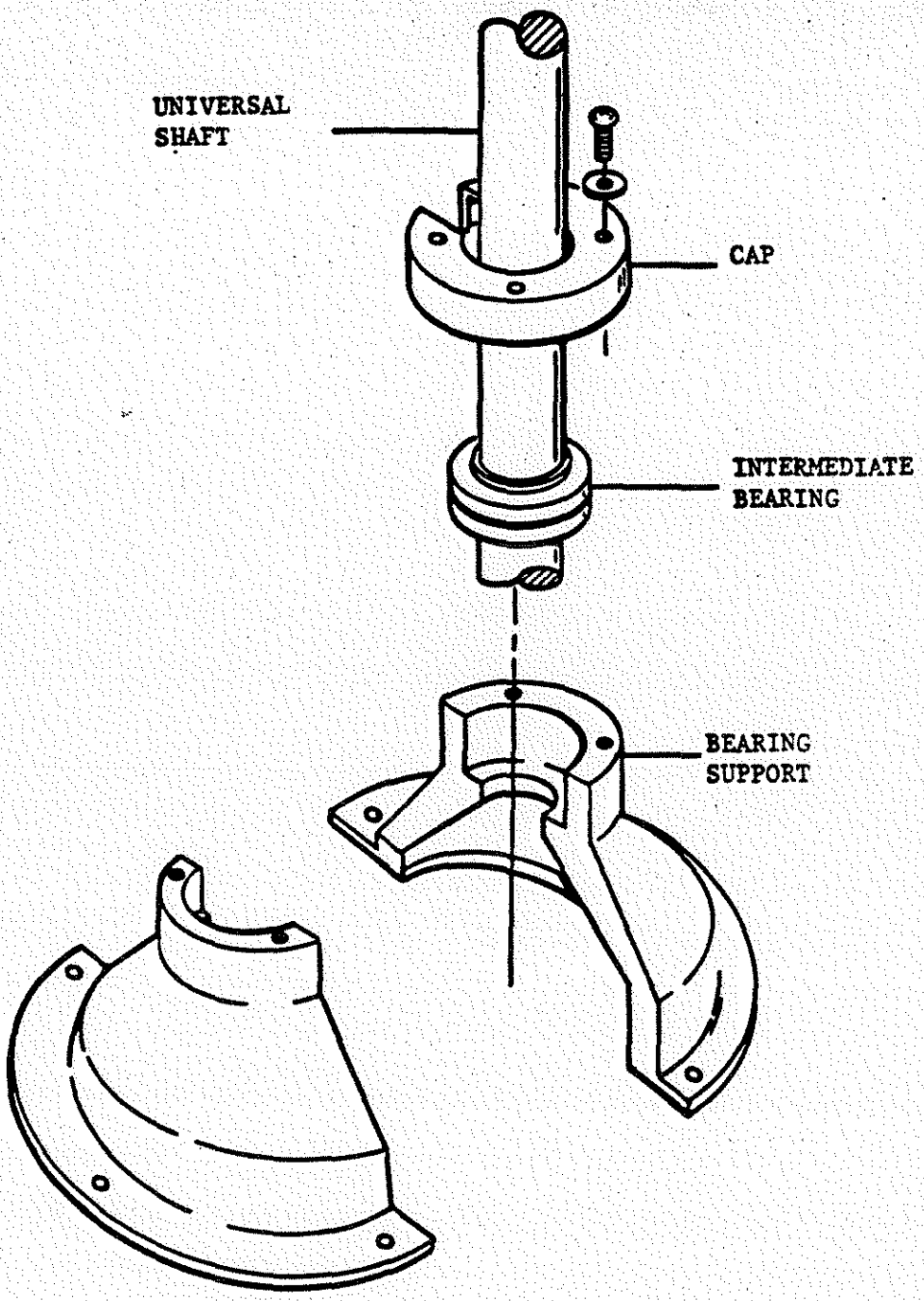

UNIVERSAL SHAFT
CAP
INTERMEDIATE BEARING
BEARING SUPPORT

Figure 2

COMPILED	OWEN
APPRV	D C R
ISSUE DATE	02/06/85
REV DATE	07/29/96
CHG LTR	F

SHOP PRACTICE

STEERING COLUMN & UNIVERSAL SHAFT INSTALLATION

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-14116

PAGE
1 OF 1

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0014-005 FOR STEERING COLUMN AND UNIVERSAL SHAFT INSTALATION.

COMPILED	OWEN	SHOP PRACTICE STEERING COLUMN & UNIVERSAL SHAFT INSTALLATION	SECTION NUMBER 33-14116
APPRV	DCR		PAGE 1 OF 1
ISSUE DATE	02/06/85	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-34
REV DATE	03/18/93		
CHG LTR	D		

1. UNIVERSAL JOINT PHASING

1.1 UNIVERSAL SHAFTS MUST BE PROPERLY PHASED TO PROVIDE SMOOTH STEERING WHEEL ROTATION.

1.2 TO FACILITATE HANDLING AND ASSEMBLY, ESPECIALLY FOR CONVENTIONAL VEHICLES, THE SLIP SHAFT MAY BE REMOVED FROM THE FEMALE SPLINE UNTIL THE CAB IS INSTALLED ON THE CHASSIS. CARE MUST BE TAKEN THAT THE SPLINES ARE NOT DAMAGED.

1.3 WHEN RE-ASSEMBLING THE UNIVERSAL SLIP SHAFT, THE TIMING MARKS (ARROWS) MUST BE ALIGNED. REFER TO FIGURE #1.

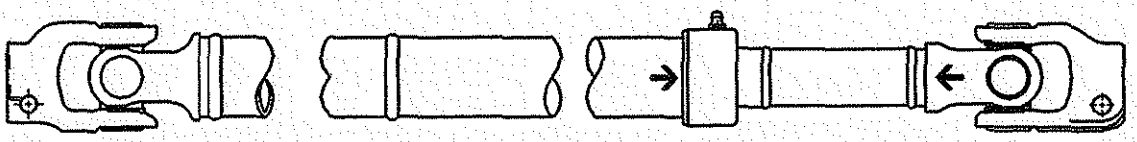


FIGURE 1

2. PINCH BOLT INSTALLATION

2.1 ALL FASTENERS, OTHER THAN PROVIDED ON SUB-ASSEMBLIES BY COMPONENT VENDORS, WILL BE GRADE 8. THE FASTENERS AND TORQUE ARE SPECIFIED ON ENGINEERING DOCUMENTATION AND ARE COLOR CODED TO HELP ENSURE PROPER APPLICATION.

2.2 APPLY COLOR TORQUE SEAL TO THE EXPOSED BOLT THREADS AND NUT AFTER TORQUING.

D 2.2.1 ASSEMBLER: ORANGE TORQUE SEAL.

D 2.2.2 QUALITY ASSURANCE: GREEN TORQUE SEAL.

3. STEERING GEAR YOKE INSTALLATION

3.1 STEERING GEAR YOKES AND SHAFTES ARE SPLINED AND HAVE AN EXTERNAL FLAT AS WELL AS A WHISTLE NOTCH FOR THE PINCH BOLT TO INSURE CORRECT INSTALLATION. REFER TO FIGURE #2.

3.2 BE SURE THAT THE UNIVERSAL JOINT IS LUBRICATED BEFORE INSTALLING THE GEAR YOKE.

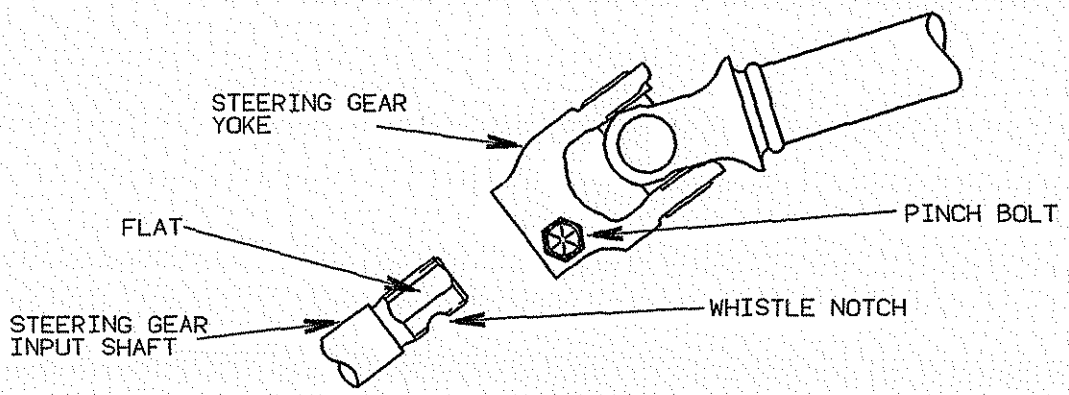


FIGURE 2

30N ID=

COMPILED	OWEN	SHOP PRACTICE	SECTION NUMBER 33-14118
APPRV	D C R		
ISSUE DATE	02/06/85	FINAL STEERING ADJUSTMENTS	PAGE 1 OF 1
REV DATE	07/29/96		
CHG LTR	E	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0014-006 FOR STEERING SYSTEM FINAL ADJUSTMENT PROCEDURE.

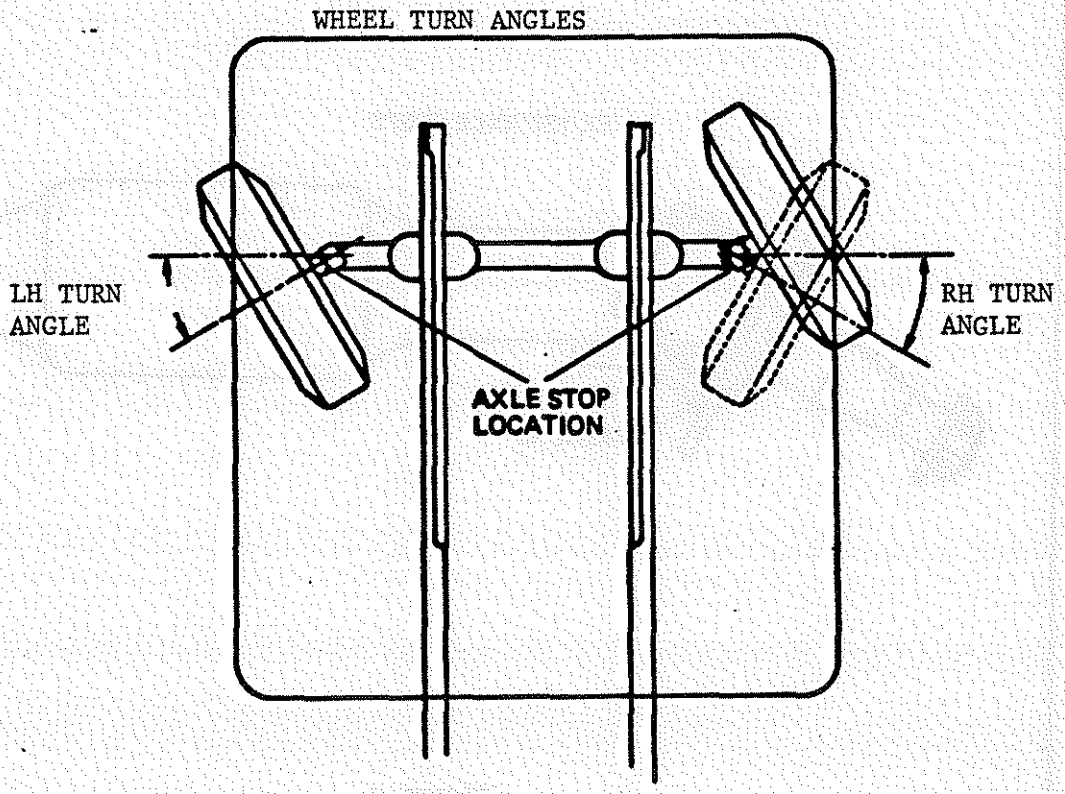
D
D

A. AXLE WHEEL TURN ADJUSTMENT - ALL STEERING SYSTEMS

All axles except the FK-120 are provided with a set screw and lock nut type axle stop. The FK-120 uses a stud and spacer washer arrangement (remove and discard spacers as required). See Figure 1, Page 2.

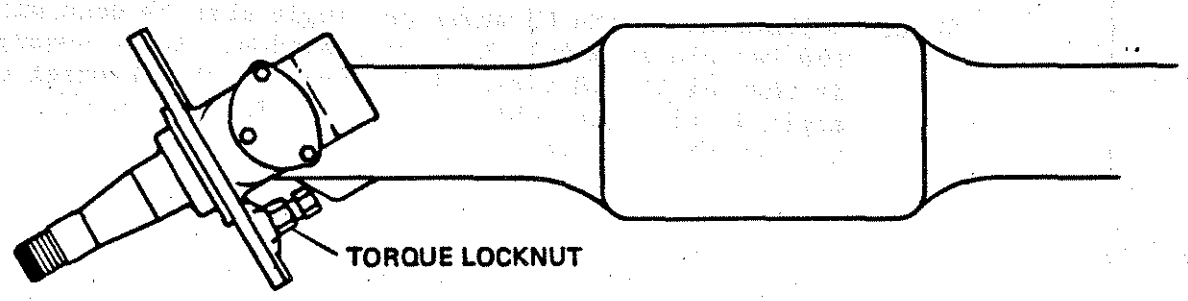
This adjustment is provided on the rear side of the spindle and contacts the axle beam limiting turn angle. The turning angle limits must be set before any other adjustments are made.

NOTE: Adjustment of the LH wheel cut angle must be done with the vehicle in a full LH turn position. Angle measurement is then on the LH tire. Adjustment of the RH wheel cut angle is with the vehicle in a full RH turn with measurement on the RH tire.



WHEEL TURN ANGLES, CONTINUED

AXLE STOP ADJUSTMENT
ALL AXLES EXCEPT FK-132



FK-132 AXLE STOPS

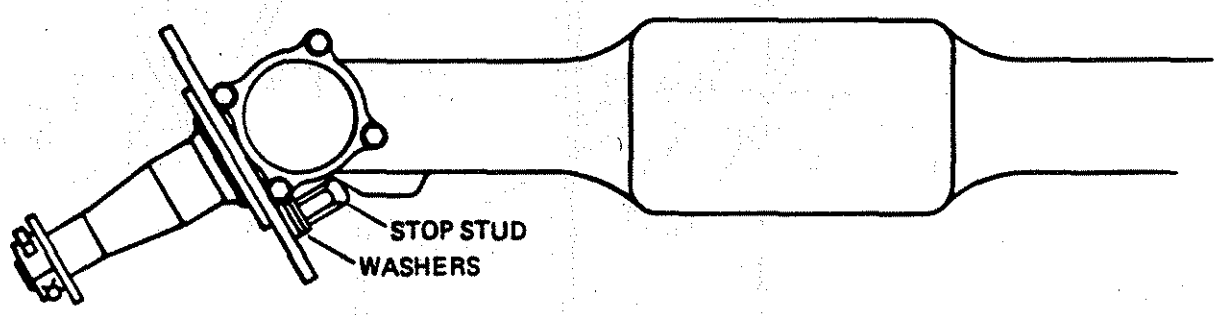


FIGURE 1

NOTE: Axle stops are to be set per Table 2 at axle sub-assembly. Failure to do so may cause irreversible adjustment of a Ross TAS 65 steering gear.

Maximum turning angle is determined by vehicle clearances and is highly variable. Axle stops are to be set to provide a minimum of .50 inch clearance between the tire and the nearest non-moving chassis component or .75 inch to the nearest moving component.

On vehicles with manual steering, the axle stop setting must limit steering wheel travel to 4 1/3 turns in each direction from center.

The following standard turn angle charts are used for final adjustment. Tire and wheel combinations not shown may require decreasing the standard setting to maintain the required clearances. Care must be taken when the setting must be decreased for a Ross TAS 65 steering gear: The steering gear must not be connected to the axle (via the draglink) while setting the axle stops.

TABLE 1: Max tire size 44.75 OD X 11.50 section width
(std. 275.5, 11R 24.5, 11.00R22, etc.)

: Spoke or disc wheels

: Std. rims or discs (Steel or aluminum)

D : Due to Ackerman geometry effects, vehicles with over 180 wheelbase tend to have right hand wheel cuts at the low end of the tolerance range.

D

FRONT AXLE MODEL	STANDARD TURN ANGLE				
	AXLE FORWARD		AXLE BACK		
				POWER STEERING	
	MANUAL STEERING	POWER STEERING	MANUAL STEERING	ROSS TAS-65 SINGLE	SHEPPARD, ROSS HFB-70, TAS-65 DUAL
ROK, FF-961	33° ±3°	35° ±3°	35° ±3°	48° +2° -8°	45° ±5°
ROK, ALL EXCEPT FF-961	33° ±3°	35° ±3°	35° ±3°	40° ±3°	40° ±3°
GKN, FK120	33° ±3°	35° ±3°	35° ±3°	45° ±3°	45° ±3°
ETN, EFA 12 FA	33° ±3°	35° ±3°	35° ±3°	45° ±3°	45° ±3°

TABLE 2:

FRONT AXLE MODEL	AXLE STOP PRE-SET ANGLE (MAXIMUM)				
	AXLE FORWARD		AXLE BACK		
	MANUAL STEERING	POWER STEERING	MANUAL STEERING	POWER STEERING	
				ROSS TAS-65 SINGLE	SHEPPARD ROSS HFB-70 TAS-65 DUAL
ROK, FF-961	33°	33°	35°	33°	33°
ETN, EFA-12F4	33°	30°	35°	40°	40°
GKN, FK-120	33°	30°	35°	40°	40°
ROK, FG-941	33°	33°	35°	33°	33°
ROK, FL-941	33°	30°	35°	30°	30°

D

A. WHEEL TURN ANGLE, CONTINUED

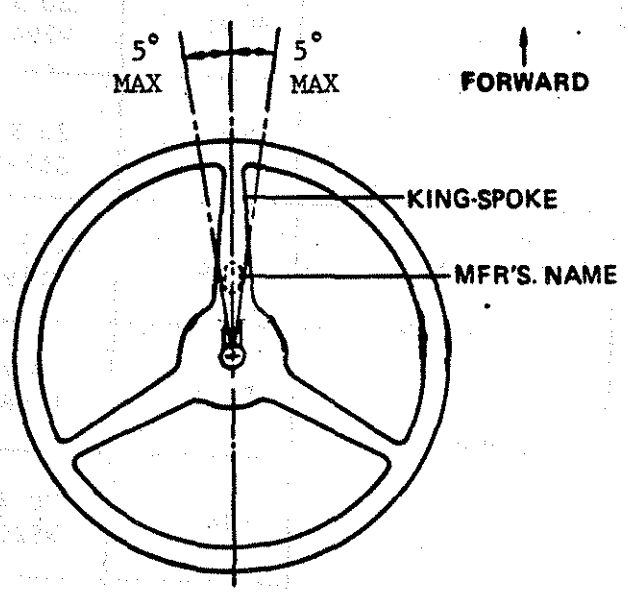
Table 3 : High capacity front tires
FL-941 axle only
Power steering only
Setback axle only

TIRE SIZE	WHEEL TYPE	RIM SIZE & P/N	TURNING ANGLE
13/80R20	Disc	20 X 8.5 R79440-2	37½°
	Spoke (FA705)	20 X 8.5 312-5-1	40°
13/75R22.5	Disc	22.5 X 9.0 28192	40°
14/80R20	Disc	20 X 10.0 R48680-2	40°
	Disc	20 X 10.0 R92062-2	35°
	Spoke (FA850)	20 X 10.0 1020 MD	35°
15-22.5 15R22.5	Disc	22.5 X 12.25 28165	32½°
	Spoke (FA705)	22.5 X 12.25 31678	40°

B. KING SPOKE ADJUSTMENT

The steering wheel must be positioned in all vehicles so that when traveling straight, one spoke is straight up as viewed from the driver's seat. This gives optimum view of the instrument panel. This spoke is referred to as the king spoke and is identified by the manufacturer's identification on the underside of the spoke.

NOTE: Steering column and driveline is sub-assembled using pinch bolts and Loctite adhesive. Under no circumstances are these connections to be used for king spoke adjustment. (Ref. 33-14114)



VIEW LOOKING DOWN ON WHEEL FROM DRIVER'S SEAT

NOTES:
1. Adjustment check is to be made on dynamometer if available or road test.
2. The king spoke is positioned as shown above for the unloaded vehicle.
3. Potential road crown is not considered at this adjustment.

B. KING SPOKE ADJUSTMENT, CONTINUED

King spoke adjustment must not be attempted until the drag link has been adjusted to position the pitman arm as shown on the individual steering gear installation diagrams with the weight of the vehicle on the front tires.

Adjust the king spoke position as shown on Page 5 by re-positioning the steering wheel on the steering column. Do not use the drag link to adjust king spoke location.

Note that in straight ahead condition, power steering gears may not be "centered". Manual steering gears must be centered.

C. BLEEDING THE HYDRAULIC SYSTEM

C Ross HFB 70 power steering gear and RCB 64 slave gear are provided with a bleed screw; Sheppard and Ross TAS 65 power steering gears bleed back to the reservoir and only require proper setting of the unloading valves.

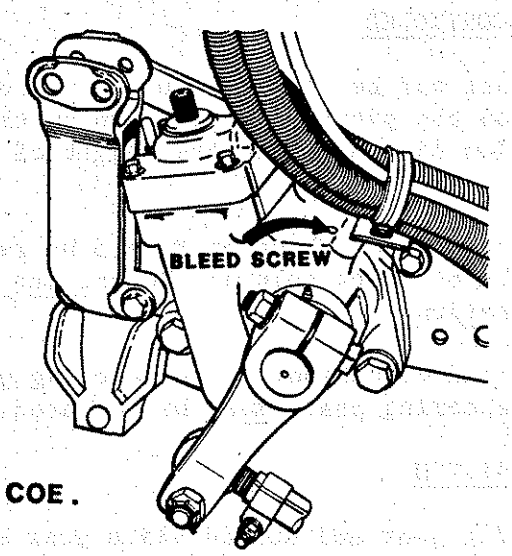
C PROCEDURE FOR ROSS HFB 70 and RCB 64 POWER STEERING:

System bleeding should be completed before final poppet relief valve settings are made. However, for bleeding, they must be set to relieve pressure at full left and right turns.

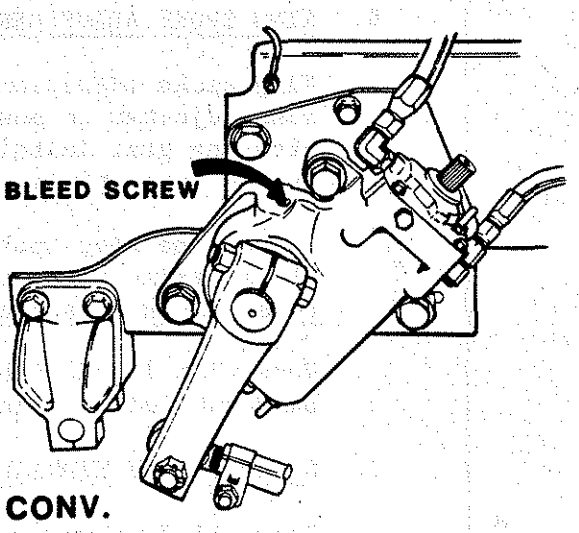
Check and fill reservoir as required during the following operations, ensuring the fluid level does not drop significantly.

With engine running faster than idle speed, steer the vehicle from full left to full right and back several times. Return the steering wheel to straight ahead and let the engine idle.

Loosen the manual bleed screw (see top of Page 7) to allow air and aerated fluid to "bleed out" around the bleed screw. When only clear (non-aerated) fluid is bleeding out, close the bleed screw. Repeat entire bleeding operation 3 or 4 times until only clear (non-aerated) fluid is discharged when the bleed screw is loosened. Torque the manual bleed screw to 27-33 in-lb.



COE.



CONV.

PROCEDURE FOR SHEPPARD and Ross TAS 65 POWER STEERING:

Bleeding is accomplished by steering the vehicle from full left to full right and back several times with the engine running faster than idle speed. Full left and right turns must open unloading valves.

D. INTEGRAL POWER STEERING UNLOADING VALVE (POPPET RELIEF)
PROCEDURE FOR ALL EXCEPT ROSS TAS 65

1. Wheel turn angles must be set by adjusting the axle stop screws (33-14118, Page 1-4) prior to adjusting the poppet relief screws.

D 2. Install a pressure gauge on the pressure side of the gear at the tee provided. (Maximum operating pressure in the system is 2175 PSI).

3. Start the engine and allow oil to heat up. This is done by turning the wheel several times in each direction.

D 4. Turn to a full lock position and check pressure. It should not exceed a slight override of the 2175 psi relief valve setting. Do not maintain this condition for more than 5 seconds to prevent over heating and/or damage to gear, pump, or other components.

D 5. Release the steering and turn in the appropriate poppet screw so that the pressure gauge reads 300-1200 psi when there is .06 to .12 inch clearance between the stop screw and axle beam.

NOTE: For COE vehicles, the LH turn angle is controlled by the input shaft end (top) poppet screw and RH turn angle by the bottom screw.

For Conventional vehicles, the RH turn angle is controlled by the input shaft end (top) poppet screw and LH turn angle by the bottom screw.

6. Turn the wheel in the opposite direction and repeat the above for the opposite wheel.

7. Torque lock nuts on both top and bottom set screws while holding the adjustment screw. Ross gears only (See 33-14101).

E. PROCEDURES FOR ROSS TAS 65

1. Ross TAS 65 steering gears are equipped with "resettable automatic poppets". (fig. 1) Care should be taken to not allow the gear output shaft to turn more than 25° in either direction until the gear is installed on the vehicle and the wheel turn angles are set by adjusting the axle stops according to 33-14118, Page 1-4.

2. Install a pressure gage on the pressure side of the gear at the tee provided (maximum operating pressure in the system is 2175 psi).

3. Start the engine and allow oil to heat up. This is done by turning the wheel one turn in each direction several times.

4. Turn to a full lock position and check pressure. It should read 300-1200 psi. If it is above this pressure, release steering wheel immediately.

5. Turn the wheel in the opposite direction and repeat the above procedure. Both poppets are now set (fig 2).

6. If pressure is above 1200 psi, the poppets may have been incorrectly set before hand. To set them now will require using a special "Adjusting Tool Kit" (fig 3) as follows:

   a. Put tires into "straight ahead position" and turn off engine.
   b. Remove the end plug and washer from the lower end of gear (opposite the input shaft end).
   c. Install adjusting tool such that screw is flush with the jam nut.
   d. Torque to 38-42 ft. lbs., and restart engine.
   e. Rotate steering gear to move rack piston to the lower end of gear. On a COE this would be a RH turn and on a conventional a LH turn. Rotate until initial torque rise if felt.
   f. Continue to rotate until torque at the steering wheel exceeds 475 in.-lb. (Fig. 4).
   g. Turn wheel in the opposite direction to set the upper end poppet according to step 4 above (Fig. 5).

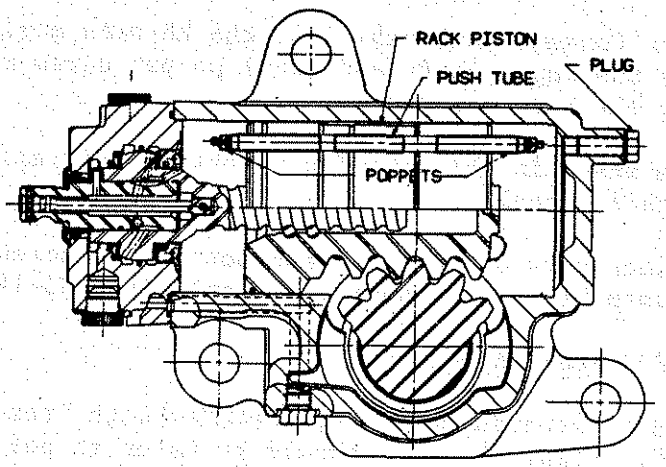


FIG 1. AS RECEIVED

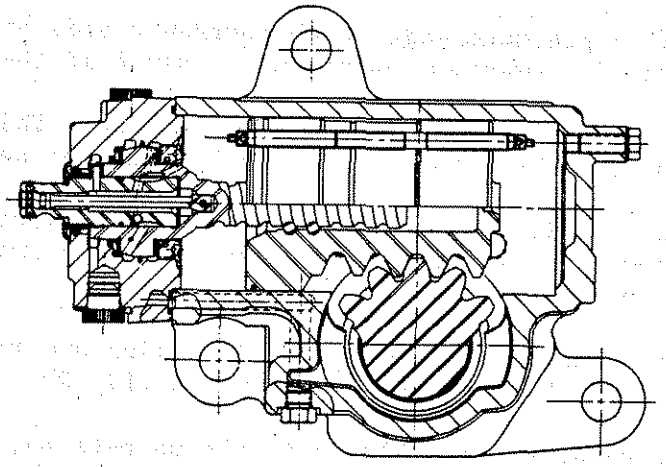


FIG 2. PROPERLY SET POPPETS

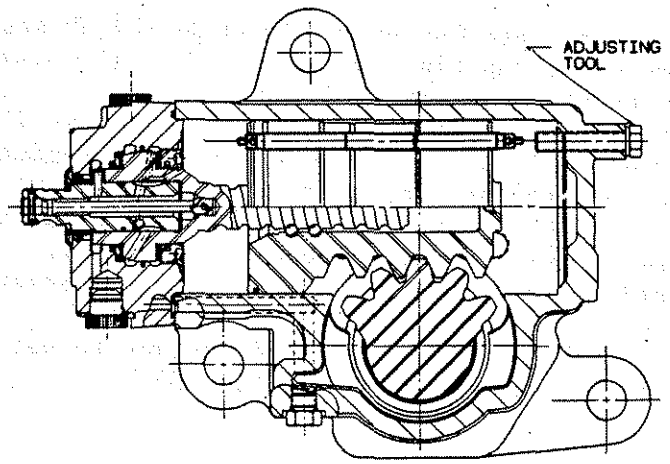


FIG 3. MISADJUSTED POPPETS

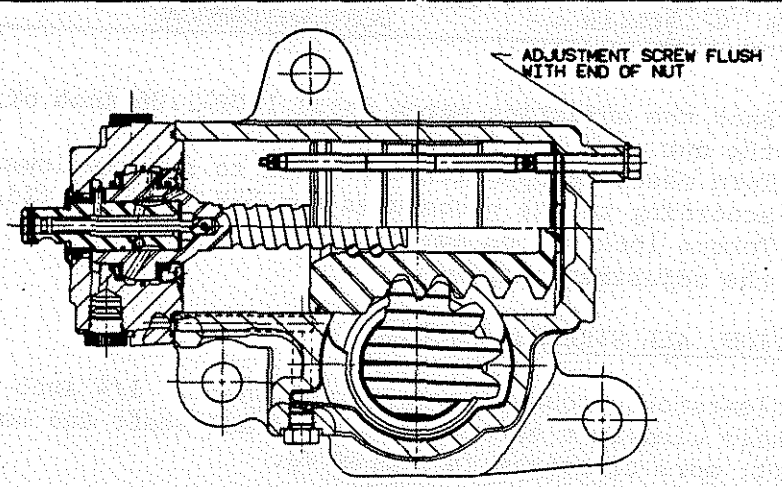


FIG 4. RESET POPPET SLEEVE ON TOP SIDE OF PISTON

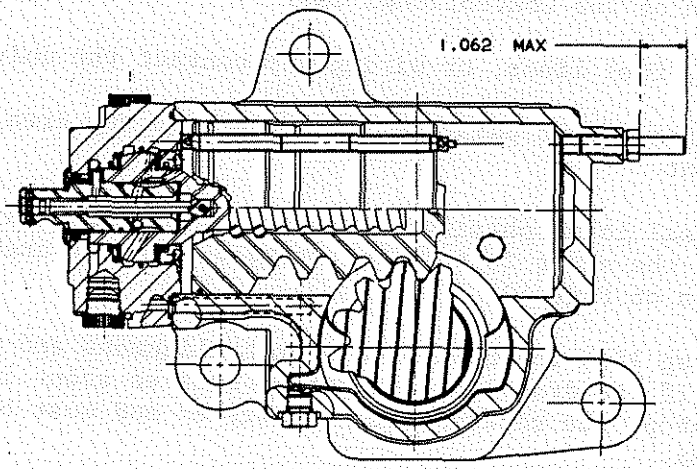


FIG 5. READJUSTING UPPER POPPET

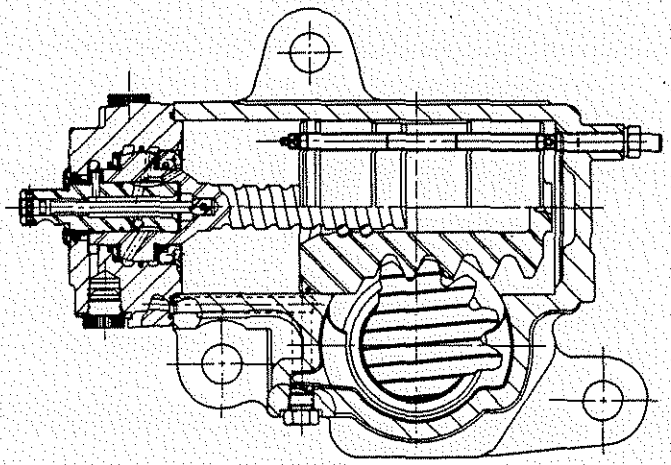


FIG 6. READJUST LOWER END POPPET

D

h. Back the adjusting screw until 1.00-1.06 inch of screw is beyond the nut.
i. Turn wheel in opposite direction to set the lower end poppet according to the procedures for HFB 70 above (fig 6).
j. Torque lock nut on adjusting tool to 38-42 ft.-lbs. while holding the adjustment screw.

E. INSPECTION, ALL STEERING SYSTEMS

Check clearances around the universal shaft. 1/4 inch is the minimum acceptable clearance between the universal shaft and any chassis or cab part; more clearance is preferred.

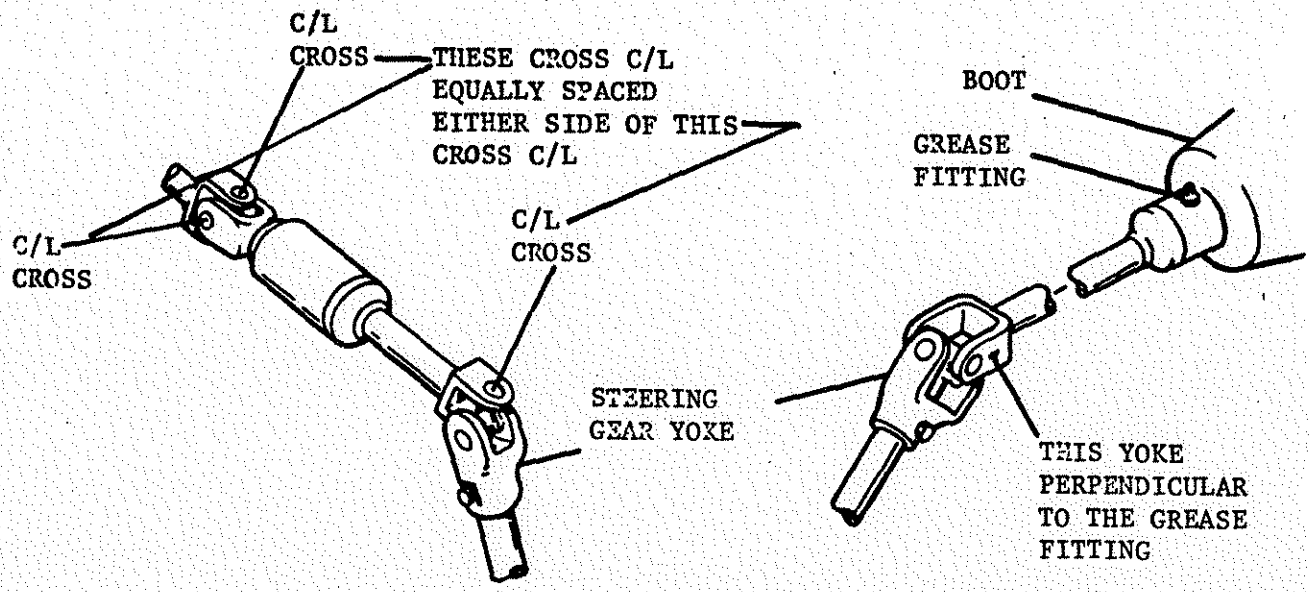
Potential trouble spots include brake valve fittings under the COE dect (Note that the clearance may change as the cab is tilted) and the nose skin of the Conventional cab.

No air lines, fuel lines, or wiring may contact the universal shaft.

If the universal shaft paint is scraped off in any area, apply touch-up paint.

Check universal joint phasing; although the alignment arrows are only visible when the shaft is totally extended, a quick check can be made as shown on Page 13.

Check the drag link for ball stud socket alignment and pinch bolt tightness. If the drag link can not be rotated about its axis by 25 stop to stop, the sockets are not aligned and must be adjusted per 33-14108A.



COE
(CAB TILTED)

CONVENTIONAL

A. MANUAL STEERING GEARS

Initial lubrication of the steering gear will consist of filling the case with approved lubricant (Ref. 33-00102).

Approved lubricant will consist of one of the following:

a. For standard use of vehicle in temperatures of 10 degrees F and up	48-2174-090 MP gear lub SAE 90
b. For operation of vehicle at temperatures continuously below 30 degrees F*	48-2174-075 MP gear lub SAE 75

* Specification sheet must specify cold weather lubrication in all locations.

B. POWER STEERING GEARS

Initial lubrication will consist of filling the reservoir with approved lubricant (See 33-00102).

A

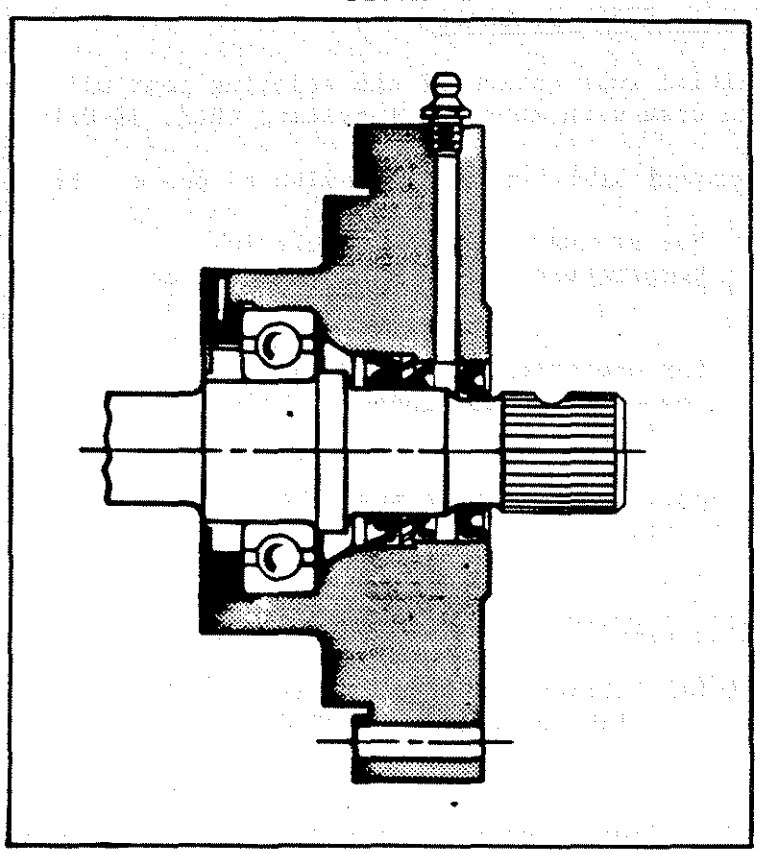
NOTE: Power steering reservoir location is specified in 33-14110. When the reservoir inlet is below the pump inlet, the pump may require priming at initial fill by filling the pump through the inlet fitting until it will accept no more fluid.

Sheppard power steering gear, in addition to the normal hydraulic oil fill, requires the input shaft be lubricated at a grease fitting in the input shaft bearing cap. (Figure 1)

C. UNIVERSAL SHAFTS

All cross assemblies and the sliding joint are to be lubricated with approved lubricant, 48-109-001. See Figure 2

FIGURE 1



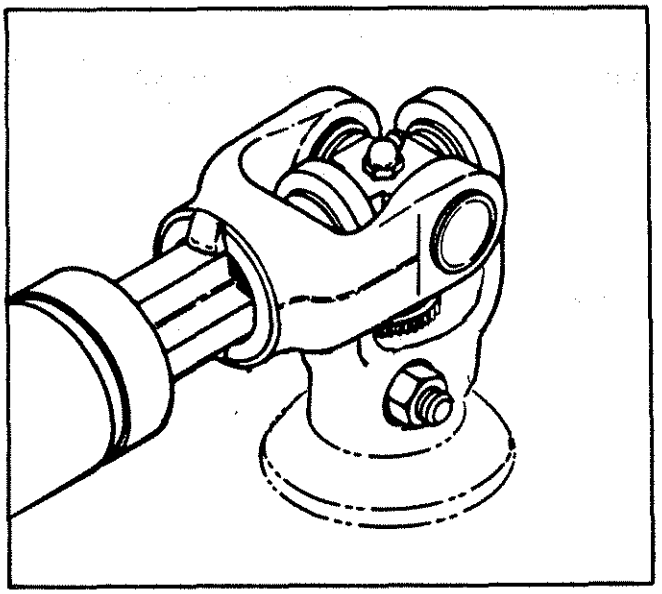


FIGURE 2

COMPILED	EVENS	SHOP PRACTICE STEERING SYSTEM TROUBLE SHOOTING	SECTION NUMBER 33-14301
APPRV	D C R		PAGE 1 OF 1
ISSUE DATE	02/06/85		
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	B		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0014-007 FOR STEERING SYSTEM TROUBLE SHOOTING.

A. MANUAL STEERING

PROBLEM	POSSIBLE CAUSE	CORRECTION
No recovery when leaving a turn.	Low tire pressure.	Inflate the tires.
	Binding in the steering driveline universal joints.	Check the universal joints for damage and inadequate lubrication.
	Steering linkage binding or lack of lubrication.	Replace components, adjust, or lubricate, as required.
	Incorrect front axle wheel alignment.	Align the wheels.
	Steering gear requires preload adjustments.	Adjust preload.
Excessive lash or free play at the steering wheel.	Steering components loose.	Inspect parts for damage caused by the looseness. Replace damaged components if required.
	Steering gear mounting bolt nuts are loose.	Tighten the nuts to the torque values given under the "SPECIFICATIONS" section of this subject.

B. INTEGRAL POWER STEERING

PROBLEM	POSSIBLE CAUSE	CORRECTION
Pressure relief does not relieve with poppet screws full in.	Pitman arm not positioned per the installation diagram.	Do it like the drawing.
Spindles will not turn to full axle stop.	Relief plunger improperly adjusted.	Adjust relief screw.
	Pitman arm improperly installed.	Reinstall pitman arm in accordance with installation diagram.
Excessive backlash.	Loose components.	Tighten as necessary.
	Low oil volume.	Inspect pump and replace if necessary.
No recovery.	Front wheel alignment incorrect.	Align the front whe following the instruc tions given in the 10 Group of this manual.
	Front axle components binding.	Adjust or replace the front axle components.
	Pump flow insufficient.	Check the power steering pump.
	Tire pressure low.	Inflate tires to the specifications given in the 13 Group of this manual or the applicable tire manufacturer's specifications.
Steering extremely light in one or both directions.	Bent or damaged reversing springs.	Check for impact damage and replace gear.
Steering input not smooth (seizing, binding)	Defective universal joint.	Check and replace as required. Refer to the 14 Group of th manual for instruct

B. INTEGRAL POWER STEERING, CONTINUED

PROBLEM	POSSIBLE CAUSE	CORRECTION
Steering input not smooth (seizing, binding), cont.	Universal joint not properly phased.	See 33-14114
	Low oil flow.	Check flow
Darting, wandering (oversteering)	Oil flow too high.	Check flow rate, correcting as necessary.
	Air trapped in steering gear.	Bleed air from the system. Check for air leak on suction side of the power steering pump or prime pump.
	Front axle alignment not correct.	Align front axle. Refer to the 10 Group of this manual for instructions.
Wheel steering hard in one or both directions.	Bent or damaged kingpins and tie rods.	Repair or replace kingpins and tie rods. Refer to the applicable front axle manufacturer's service manual for instruction
	Power steering pump relief valve spring defective.	Replace pump.
	Low oil level in power steering reservoir.	Fill reservoir as required.
	Air in the system.	Bleed air from the system. Check for air leak on suction side of the power steering pump.

B. INTEGRAL POWER STEERING, CONTINUED

PROBLEM	POSSIBLE CAUSE	CORRECTION
Wheel steering hard in one or both directions, cont.	Caster and camber angles incorrect.	Correct caster angles. Replace axle if camber is incorrect.
	Metal or foreign material caught in actuating valve.	Replace gear.
Oil forced out of power steering reservoir.	Relief plungers of steering gear not adjusted properly.	Adjust relief plungers.
	Operating temperatures too high.	Refer to the problem, "High Operating Temperatures" in this chart.
Lubricating oil discolored, or smells bad.	Operating temperatures too high.	Refer to the problem "High Operating Temperatures" in this chart.
	Incorrect lubricant used.	Drain, flush, and refill system with proper lubricant.
High operating temperatures.	Oil flow restriction.	Check system back pressure, correcting as necessary.
	Oil flow too high.	Check pump flow rate, correcting as necessary.
Oil in reservoir foaming.	Air leak in suction side of the power steering pump.	Repair the air leak and the power steering pump. Refer to the 14 Group of this manual for instruction.
	Damaged power steering pump (cavitation).	Replace pump or possibly needs priming

B. INTEGRAL POWER STEERING, CONTINUED

PROBLEM	POSSIBLE CAUSE	CORRECTION
No power steering on cold start.	Power steering pump vanes not extending.	Increase engine speed momentarily to extend vanes and start pump action. This is usually a temporary and infrequent occurence and is not a cause for pump repair or replacement.
Excessive power steering pump pressure with steering gear in the neutral position.	Pinched oil return line, creating high back pressure.	Relocate oil return line.
	Damaged actuating shaft bearing.	Replace gear.
Wheel cuts restricted.	Relief plunger misadjusted or pitman arm improperly located.	Adjust relief plunger or relocate pitman arm per installation diagram.
Hard steering.	Damaged power steering pump.	Inspect pump and repair as necessary.
	Front axle misaligned.	Align front axle. Refer to the 10 Group of this manual for instructions.
Shimmy	Air in hydraulic system.	Fill and bleed the power steering hydraulic system.
	Wheels out of balance.	Balance the wheels.
	Components in steering linkage such as ball sockets on drag link or axle arm loose.	Tighten or replace steering component.
	Wheel bearing improperly adjusted or worn.	Adjust or replace wheel bearings.

		SHOP PRACTICE	33-15100
Approved			
Issued	08/30/68	FRAME, CONTENTS	
Revised	07/21/88	Chg Ltr K FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-38

PRACTICE NO.	DESCRIPTION
33-15101	WELDING STEEL FRAME RAILS
33-15102	WELDING ALUMINUM FRAME RAILS
33-15103	FRAME ALIGNMENT
33-15104	FRAME FASTENER APPLICATIONS
33-15105	CROSSMEMBER INSTALLATION
33-15106	CROSSMEMBER SHIPPED LOOSE
33-15107	FRAME SHAPING PROCEDURES
33-15108	FRAME INSERT DRILLING & CUTOUTS
33-15110	COMPONENT LOCATION
33-15111	WELDING FRAME STEEL INSERTS
33-15112	FRAME FLANGE CLEARANCES
33-15113	UNUSED HOLES
33-15114	STAMPING PROCEDURES, V.I.N.
33-15115	FRAME WARNING LABEL

COMPILED	D.WELKER	SHOP PRACTICE FRAME RAIL WELDING AND OPEN HOLES	SECTION NUMBER 33-15101
APPRV	MORRISON		
ISSUE DATE	04/27/65		PAGE 1 OF 1
REV DATE	03/12/92	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	H		P3131H-01

A. NO FRAME RAIL WELDING APPLICATIONS, EXCEPT TRACTOR TAPER WELDING, IS TO BE CONSIDERED WITHOUT CORPORATE ENGINEERING APPROVAL.

B. IT IS THE INTENTION TO HOLD FRAME RAIL OPEN HOLES TO A MINIMUM; HOWEVER, EXTRA FRAME RAIL HOLES RESULTING FROM STANDARD RAIL PIERCING FOR SOME MODELS, TOOLING REQUIREMENTS, AND LATE CUSTOMER CHANGE REQUESTS WILL OCCUR.

OPEN HOLES, WHEN THEY OCCUR, ARE TO BE LEFT OPEN.

FMI=018/A
TE= 3/17/92 TIME=07.36 ACCESS=NONE
IGON ID=

COMPILED	D WELKER	SHOP PRACTICE	SECTION NUMBER 33-15102
APPRV	MORRISON		
ISSUE DATE	06/03/68	WELDING FRAME RAILS- ALUMINUM	PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	D		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0015-001 FOR ALUMINUM FRAME RAIL WELDING PROCEDURE.

A. JOINT PREPARATION FOR WELDED EXTENSION & FRAME END TAPER

CAUTION: Do not weld extensions on tractor frames.

Do not use 2014-T6 frame rail material for extensions. 2014-T6 rails are color coded with yellow paint on the end of rail.

1. The joint must be strictly clean. Any gas or other by-product of combustion formed by foreign matter in the arc can weaken the weld. Clean all surfaces with vapor or solvent degreasing equipment, by swabbing with solvent, by stainless steel wire brushing or by chemical means, if necessary.

2. Cut the pieces to the proper shape as directed by the Frame Chart. If the Frame Chart is not at hand, get a copy from the Engineering Department before proceeding. The shape of the joint is important.

3. Grind ends as shown in Figure 4 so that full penetration can be made as shown in Figure 5-A.

B. WELDING EXTENSION OR FRAME END TAPER

1. Choice of Method - Consumable Electrode Welding (MIG) is the best, and probably the only, satisfactory choice for welding aluminum of the thickness range of frame rails.

2. Electrode Wire - For frame rails of aluminum alloy 6061 as currently specified, use Linde Welding Wire 4043HG 1/16 inch diameter. (5356HG is acceptable alternate wire for frame end tapers; it is not to be used for extensions.)

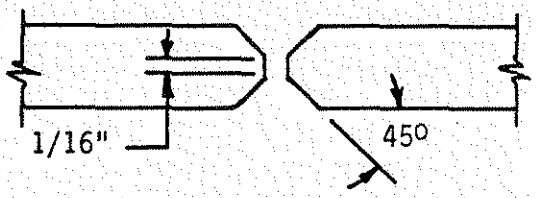
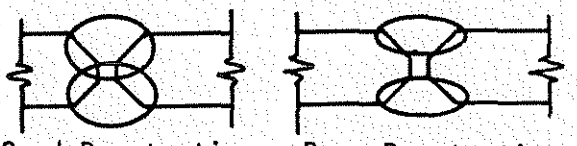


Figure 4
Joint Preparation

3. Gas - Use plain Argon Gas (Linde T) for the inert envelope of the welding arc.

4. Machine Settings - Since these vary widely, depending upon such a variety of conditions, it is probably best to leave this matter to the best judgment of the operator and his supervisor in consultation with field representatives of the equipment supplier.



Good Penetration -Correct

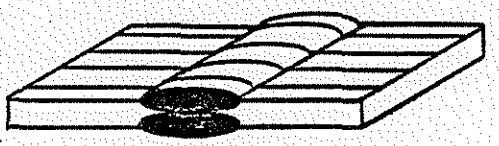
Poor Penetration -Incorrect-

Figure 5
Welding

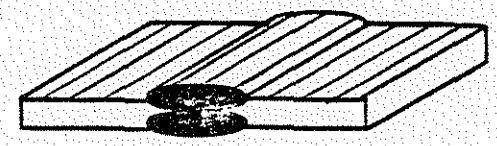
5. Technique - For frame rail welding, it is necessary to minimize total heat input to the joint. For this reason, rapid laying in of the filler metal at a relatively high temperature is desirable, starting with the web, then the flanges, and working from inside the channel, lay in a single rapid pass at the bottom of the vee. Final fill and weld is then accomplished over the same path, and without weaving motion of the electrode, first on the inside of the channel, and then the outside.

D. FINISHING

Although sanding the joint is desirable from an appearance standpoint, care should be taken not to "hollow"grind" the weld (Figure 3). Small depressions can greatly reduce the strength of the frame. Normally, any cracks that form will follow the grind marks; therefore, it is advisable to hold the sander so that the grind marks are parallel to the length of the frame.

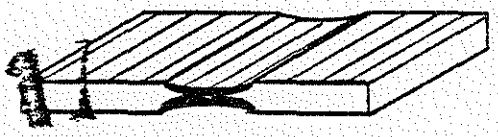


Correct Weld
Correct Grind



Correct Weld
Incorrect Grind

Incorrect Weld
Correct Grind



Incorrect Weld
Incorrect Grind

Figure 3

Cross-sectional views showing correct and incorrect methods of sanding the joint.

E. FILLING HOLES

1. FLANGE HOLES

Are not to be welded but filled with the proper size bolt and nut combination .

B

2. WEB HOLES

Are not to be welded if the center line of the hole falls outside of the central 1/3 of the web. These holes are to be filled with the proper size nut and bolt combination.

If the hole is within the central 1/3 of the web and is 1/2 " or greater in diameter, use an aluminum slug to partially fill the hole prior to welding.

If the hole is 1/2" or less in diameter, use the nut and bolt combination described above.

B

F. PROHIBITED PRACTICES

1. EXTENSIONS

Are not to be welded onto aluminum frame rails on tractors. Tractor service imposes especially high stresses in the rear frame area.

C

2. 2014-T6 (YELLOW COLOR CODE)

Are not to be welded except the tractor taper, welding on this alloy produces a severe stress corrosion band.

COMPILED	HJRARSON	SHOP PRACTICE	SECTION NUMBER
APPRV	G A	FRAME ALIGNMENT	33-15103
ISSUE DATE	04/08/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	C		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0015-002 FOR FRAME ALIGNMENT PROCEDURES.

1. Center Punch Method

The two frame rails are aligned by means of two center punch marks on the bottom flange of each rail. One is 44.00 inches from the front and the other is approximately 18.00 inches from the rear. They are both 2.00 inches from the outside face of the rail. The final, precise location is determined by accessibility. The punch mark is not to be covered by a frame reinforcement nor a casting. Whatever the locations, the punch marks for each pair of rails must be the same, both lengthwise and laterally.

The alignment is done with the frame assembled with all crossmembers and the front bumper in place, but bolts not tight. Measure on the diagonal as shown in Figure 1.

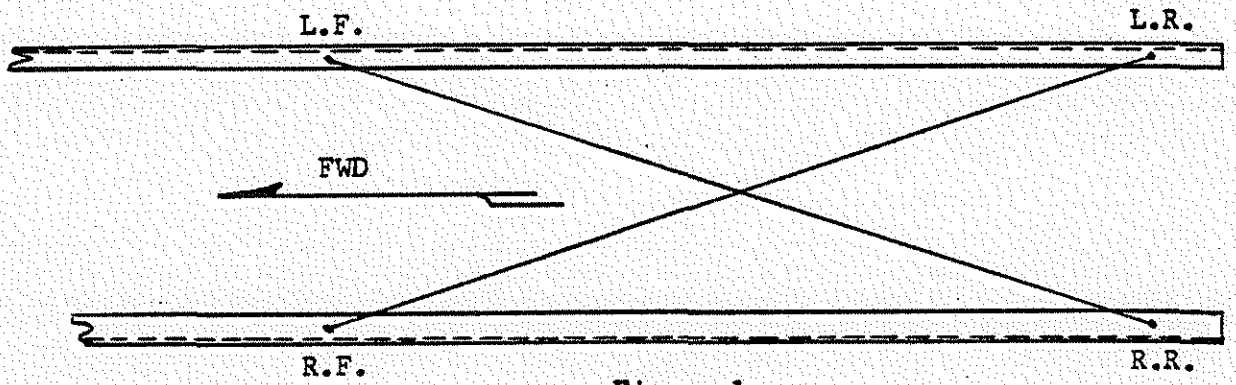


Figure 1

With a large hammer, tap the rails into alignment so that the L.F. to R.R. and R.F. to L.R. dimensions are within 1/32 inch.

Tighten several bolts on each rail, then recheck to see that the frame is still true.

Completely tighten all bolts, working on opposite sides of the frame assembly in close succession rather than along one rail and then the other. (See Cross member Installation 33-15105).

2. Pilot Hole Method

The two frame rails are aligned by means of one precisely located pilot hole in each rail. A set of alig nment fixtures engages these holes exactly square across from each other while clamps firmly hold the rails parallel at the correct distance apart. (See Figure 2 next page.)

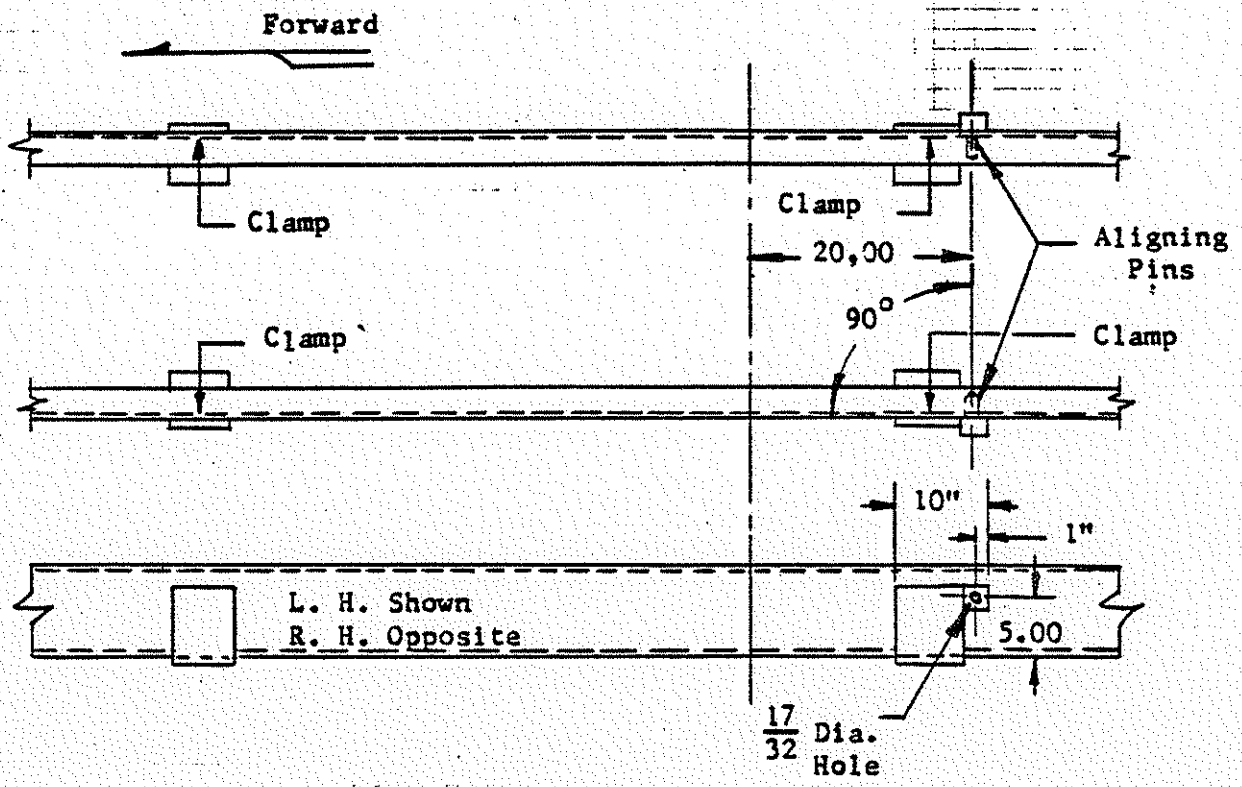


Figure 2

The pilot hole is to be drilled in a portion of the web free of attachments for ten inches and located across from a similar area on the other rail. The areas most frequently meeting these conditions and safely clear of any rear frame weld area are:

REAR SUSPENSION	HOLE LOCATION
Six Wheeler	20" aft of Equalizer Centerline
Four Wheeler	20" aft of Rear Suspension Locating Dimension
Reinforced or "gloved" six Wheeler	25" aft of Rear Suspension Locating Dimension

In some cases, the indicated location will not be clear of obstruction, and evasive tactics will have to be used to find a suitable pair of locations on the two rails. In case no suitable location can be found, it may be necessary to use Method #1.

In any case, the alignment is done with the frame assembled with all cross members and the front bumper in place. Tighten several bolts on each rail, then recheck to be sure the frame is still true.

Finally, tighten all bolts completely, working bolts on opposite sides of the frame assembly in close succession rather than working along one rail and then the other. (See Cross Member Installation 33-15105).

COMPILED	J LARSON	SHOP PRACTICE FRAME FASTENER APPLICATIONS	SECTION NUMBER 33-15104
APPRV	DCR		
ISSUE DATE	05/01/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0015-003 FOR FRAME FASTENER APPLICATIONS.

A. GENERAL INFORMATION:

1. For either aluminum or steel attachments mounted to the frame, Grade 8 hex head capscrews and Grade C prevailing torque hex nuts are used with flat hardened washers as Freightliner standard fasteners.

2. The sizes listed below are to be used in the absence of specific part numbers shown on engineering installation or assembly drawings, in engineering bills of materials, or engineering approved alternatives. C

NOMINAL SIZE	CAPSCREW	NUT	WASHER
1/2-13 UNC	23-09440-###	23-09901-108	23-09114-003
5/8-11 UNC	23-09444-###	23-09901-110	23-09114-000
3/4-10 UNC	23-09446-###	23-09901-112	23-09114-004

3. The hardened washers - zinc plated with a hardness range of 38 to 45 HRC are placed directly under the nuts and capscrew heads. They are used to distribute the load and to prevent localized overstressing of the fame rails, brackets and other parts.

4. For some components, Grade 8 flanged hex head capscrews and Grade G prevailing torque flanged hex nuts in sizes smaller than 1/2" are used for frame attachments. Washer is required only when the nut is torqued against an aluminum component. C

5. For attachments where clearance is minimal, low profile flanged head capscrews and Grade C prevailing torque hex nuts maybe used with a hardened washer under the nut.

B. SPECIAL INSTRUCTIONS:

1. Correct fastener preload is essential and is a direct result of the correct fastener torque. Refer to SPM 33-00109 for general torque specifications.

2. Hole misalignment which cocks the bolt is not to be tolerated. Hole reaming is permissible in these situations. C

3. It is essential that fastener tightening is accomplished by turning the nut and not the bolt head.

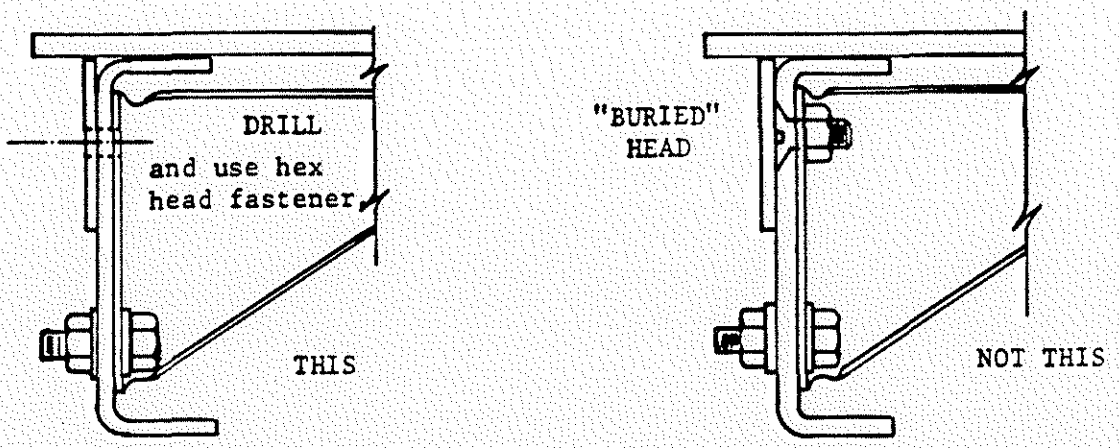
4. Bolts should never be "hammered" or "screwed" into place. The bolt and nut contact surfaces should be able to seat flush against the joint pieces by hand.

C. AVOID "BURIED" FASTENERS:

1. An externally mounted part sometimes happens to mask a mounting hole of a part mounted inside the frame rail. In such cases, it is preferable to "back drill" from the inboard side and use a regular hex head fastener through both pieces. Avoid using a flat head (countersunk) bolt for fastening the inboard part, since there is then no way to hold the head for tightening.

C. AVOID "BURIED" FASTENERS: (Continued)

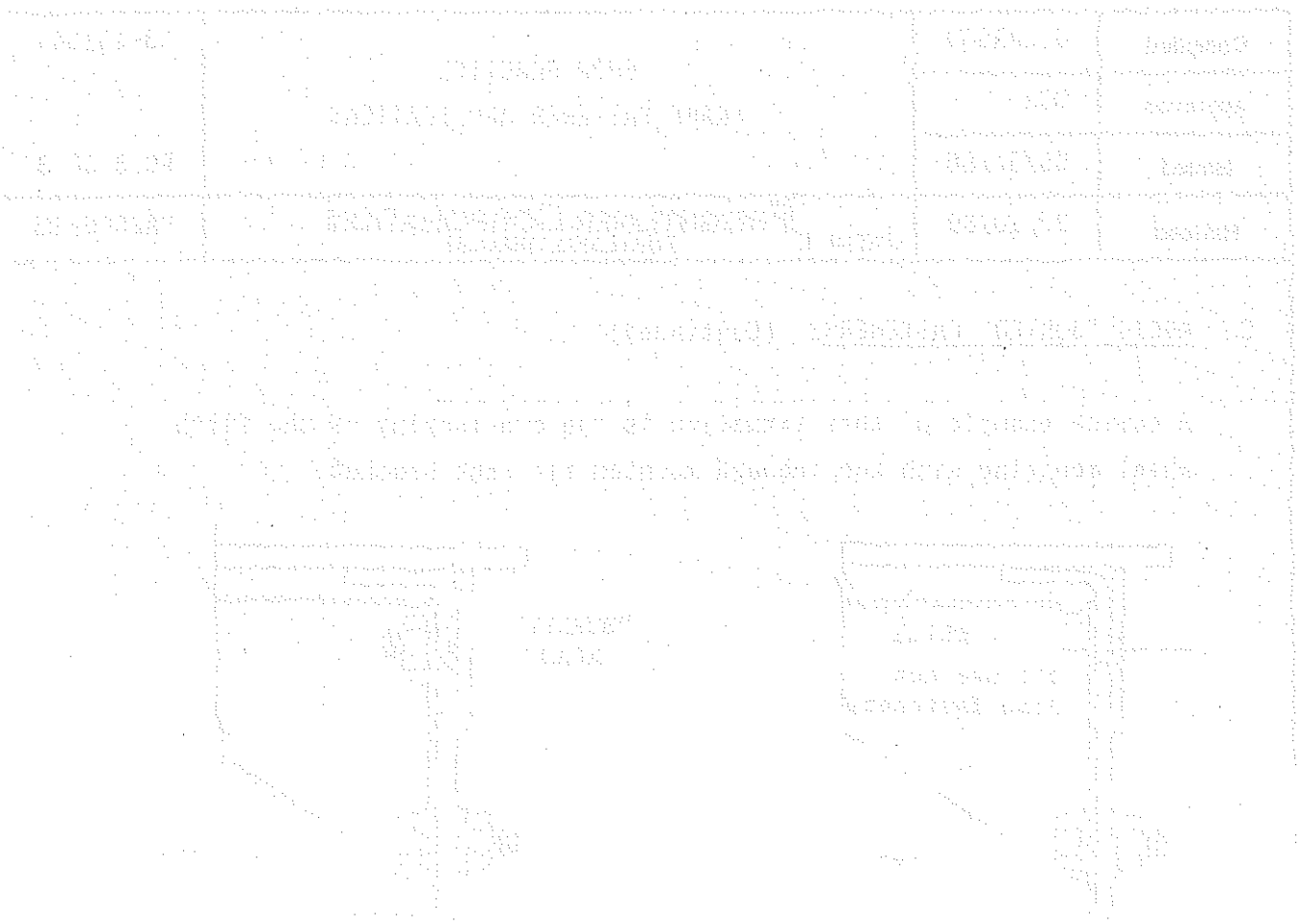
A common example of this situation is the overlapping of the fifth wheel mounting with the inboard mounted air tank bracket.



D. BOLT HEAD LOCATION:

C 1. Bolt head (excluding top flange holes) are to be inboard whenever possible. It is essential that the bolt be installed so that fastener tightening is accomplished by turning the nut and not the bolt head.

C 2. Fastener orientation may differ because of insufficient clearance or difficulty of assembly.



COMPILED	F. F	SHOP PRACTICE CROSSMEMBER INSTALLATION, GENERAL	SECTION NUMBER 33-15105
APPRV	D. WELKER		
ISSUE DATE	07/14/65		PAGE 1 OF 1
REV. DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG. LTR	G		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0015-004 FOR CROSSMEMBER INSTALLATION PROCEDURE.

Compiled	F.FREER	SHOP PRACTICE CROSSMEMBER INSTALLATION, GENERAL	33-15105
Approved	D. Welker		
Issued	7/14/65		
Revised	9-4-80	Chg Ltr B **FREIGHTLINER CORPORATION** **PORTLAND, OREGON**	PAGE 1

E

Assembly Procedure: Since many tolerances are involved, assembly procedure must be chosen to minimize their effect in the final frame structure. It is, therefore, necessary to assemble crossmembers to the frame in the following manner:

1. Install parts in their proper places in the frame, using just a few of the fasteners to position the gussets and any other auxiliary parts involved.

2. Check carefully that parts are oriented properly, flanges forward or back as required, left and righthand parts properly placed, offsets directed properly, etc.

3. Install remaining fasteners, but do not tighten.

4. Align frame rails properly spaced parallel to each other and not "diamonded". Then tighten a few bolts at each end of the crossmember, just snug enougn to prevent movement of parts.

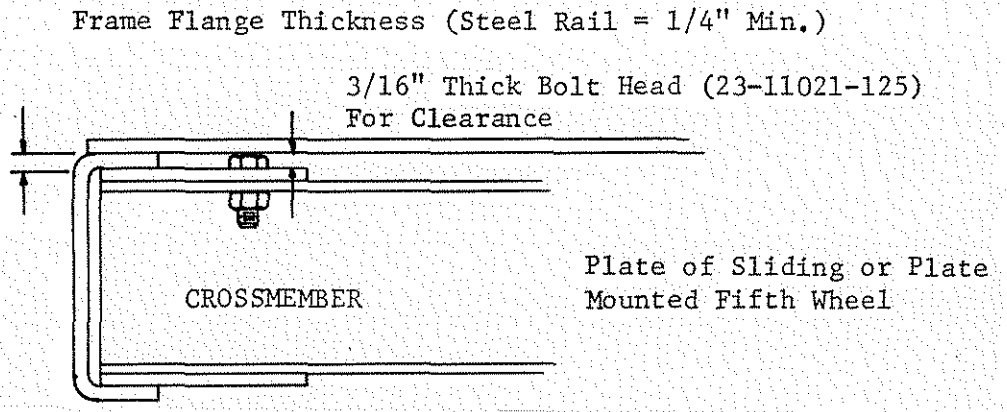
5. Bring all bolts just to a snug condition watching not to introduce strain and distortion, scattering the tightening process as widely as possible, and working opposite sides of the frame.

6. Recheck for trueness, repeating the procedure if necessary from the loose condition of Step 3; then completely tighten a few bolts at a time at each side of the frame assembly until all are brought to the proper torque.

A

2. CROSSMEMBER WITH SLIDING OR PLATE MOUNTED FIFTH WHEEL

On a steel frame, when installing a crossmember that will be under a sliding or plate-mounted fifth wheel, a special bolt with reduced head thickness of 3/16" must be used so that it will not protrude above the frame.



B

3. CROSSMEMBER AS SUPPORT FOR MINOR COMPONENTS

When holes in the flanges of alligator and other crossmembers are necessary for hose clamp screws, such holes must not be closer than 1.00 inch from the edge of the flange to the edge of the hole. It is, of course, preferable to avoid the flanges when possible and put holes in the web or face of the crossmember where no such restriction exists.

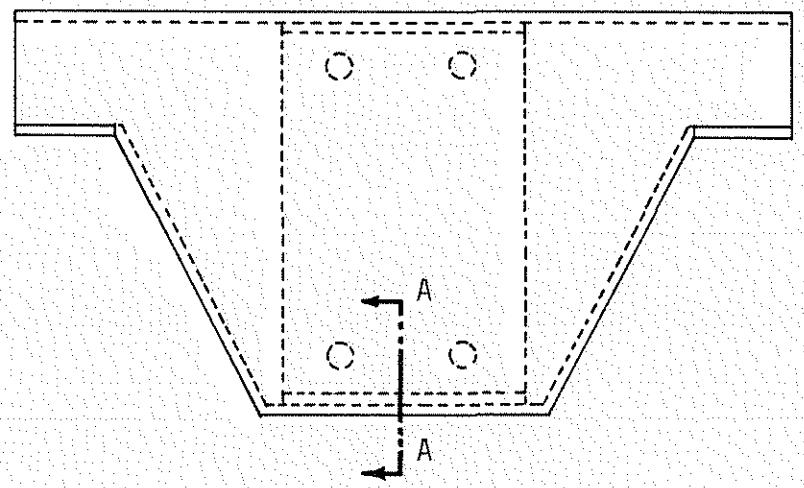
REVISED & RETYPED " " CHANGE

C

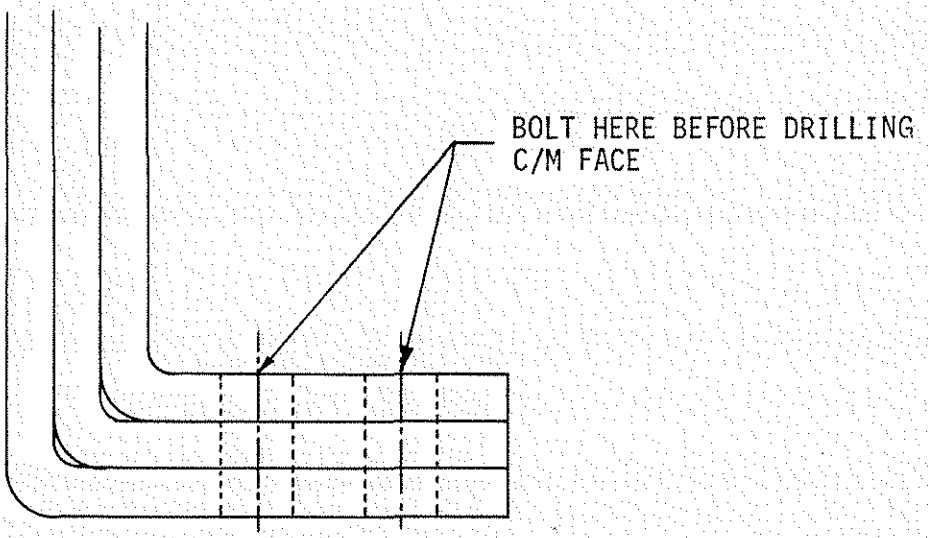
5. Drilling the Tow Crossmember for Pintle Hitch

Normally these holes are drilled as when the crossmember is made. If drilling is necessary, observe the following procedure:

The A-frame, reinforcing box and the crossmember must be bolted through the bottom flange prior to the drilling operation.



VIEW LOOKING FORWARD



REVISED & RETYPED " " CHANGE

SUSPENSION CROSSMEMBER INSTALLATION

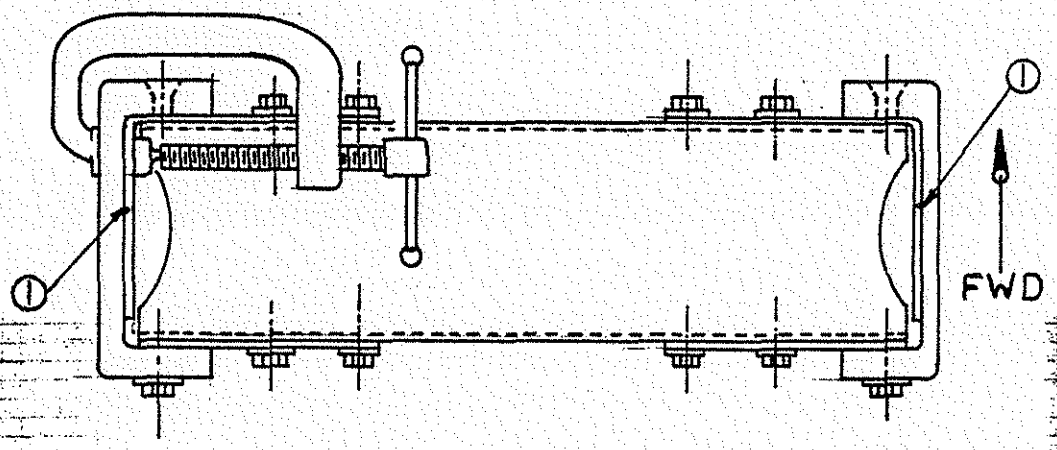
ALUMINUM RAILS

When installing the "L" shaped crossmember gusset, the following procedures are to be observed:

1. The vendor identification line, ① Must be removed in the area covered by the gusset. The line should be ground off smoothly. Grind marks should be vertical or circular. Horizontal grind marks are not acceptable.

2. The "L" shaped gusset is to be in direct contact with the inside surface of the rail.

3. The "L" shaped gusset should be clamped to the frame throughout assembly. If the bolts will not go through the existing holes, reaming, with the gusset clamped, is required.



F

REVISED & RETYPED " " CHANGE

COMPILED	F. F	SHOP PRACTICE CROSSMEMBER SHIPPED LOOSE	SECTION NUMBER 33-15106
APPRV	D. WELKER		
ISSUE DATE	07/14/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

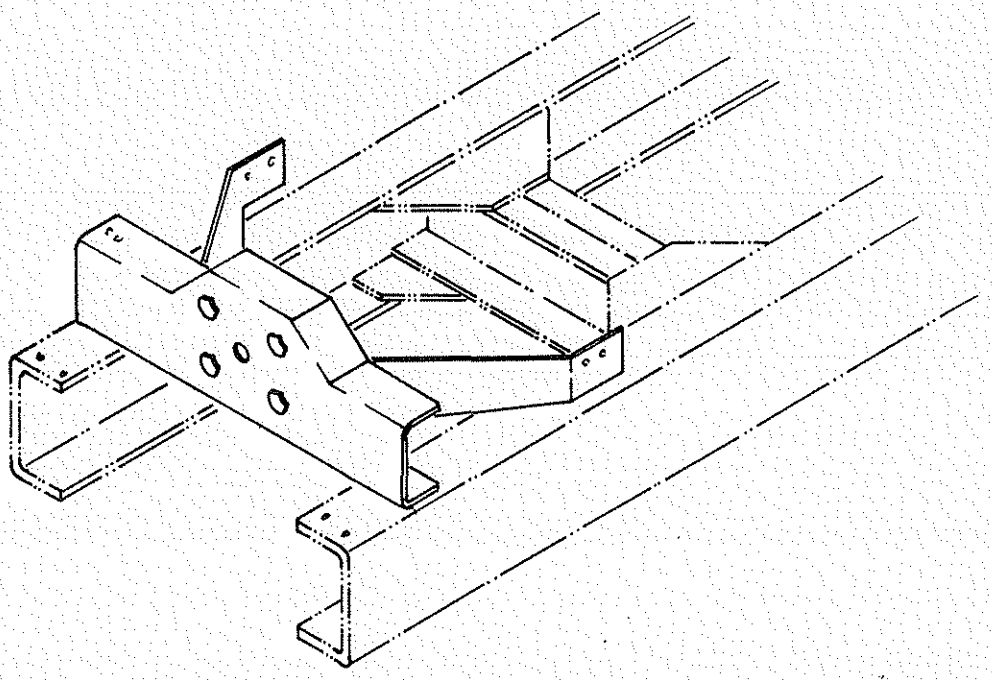
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0015-005 FOR CROSSMEMBER SHIPPED LOOSE PROCEDURE.

Compiled	F. FREER	SHOP PRACTICE CROSSMEMBER SHIPPED LOOSE	33-15106
Approved	D. Welke		
Issued	7/14/65		
Revised	9-4-80	Chg Ltr B **FREIGHTLINER CORPORATION** PORTLAND, OREGON	

When the chassis spec and/or frame chart specifiy a "ship loose" or "temp mount" rear crossmember, fasten with only two bolts through the top of the truck frame rail and the bottom lip of the crossmember. (This turned-up position is to prevent accidental mounting and use of a tow hitch on a temporarily installed member.)

When possible, install or attach the A-frame to the crossmember.

(For pintle hitch drilling of crossmember, see 33-15105, p. 3, #5.)



COMPILED	H J R	SHOP PRACTICE	SECTION NUMBER 33-15107
APPRV	G H A	FRAME SHAPING PROCEDURES	PAGE 1 OF 1
ISSUE DATE	06/07/85		
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	B		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0015-006 FOR FRAME SHAPING PROCEDURES.

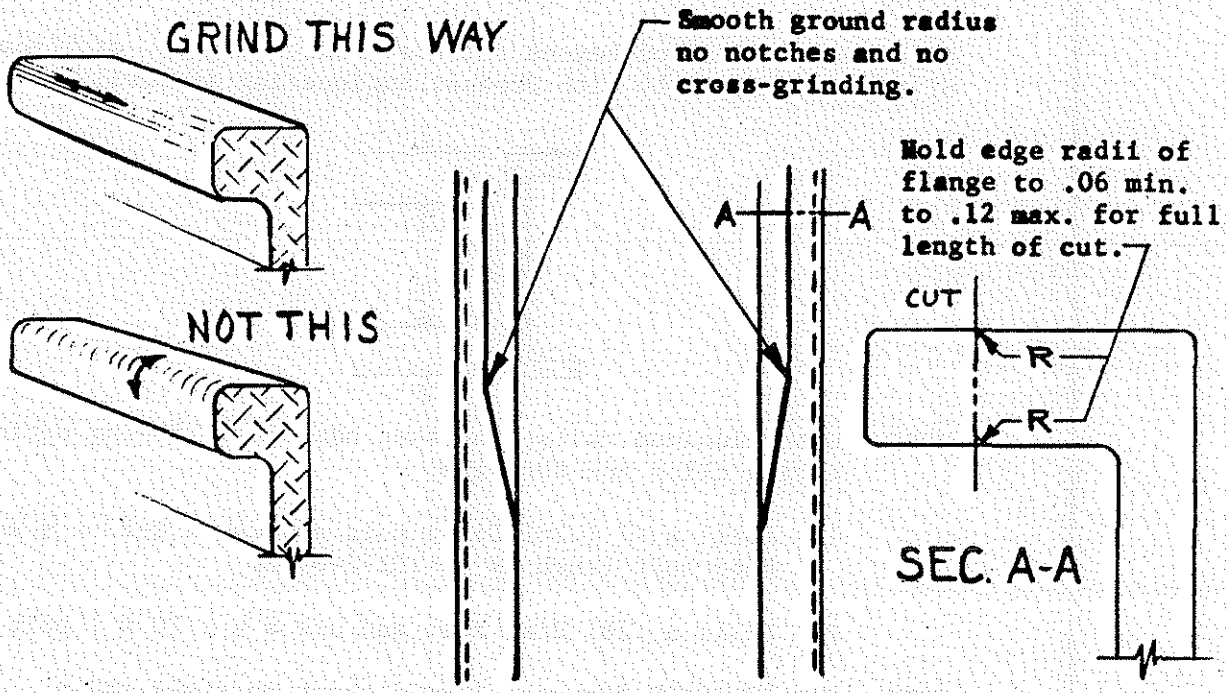
Compiled	H.J.R.	SHOP PRACTICE	
Approved	G.H.A.	FRAME SHAPING PROCEDURES	33-15107
Issued	6-7-85		
Revised	12-19-86 Chg Ltr A	FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

1. SHAPING

A

When a frame side member must be cut or shaped in a stressed area, it is imperative that smooth ground radius be used to join the sides of a re-entrant cut (see sketch). On steel rails, burning is permissable to within .060 of finished dimensions. The remaining material must be ground off. The grind in these cases should produce a smooth radius of approximately the size called for on the engineering drawing specifying the work to be done, and such work should not be done without a drawing from Engineering to cover the operation.

For best strength, the grind marks must run in the direction of the cut, and not across it. Therefore, rail cut-outs must be finish dressed using a clean, sharp rotary drum grinder or flapper wheel only. End up with a light pressure to minimize overheating and loss of surface temper. (See sketches)



2. LAYOUT

Aluminum Frame Rails - Use pencil lines and not scribed lines for layout work on aluminum frame rails. Pencil lines do not cause stress raising scratches that may later develop into starting points for structural failure. Also, pencil lines are usually more visible than scribe lines on an aluminum surface.

A

2. LAYOUT (CONT.)

Steel Frame Rails - A light scribe line may be used for frame layout on steel rails. Avoid deep scribing in possibly highly stressed areas such as on the flanges of channels and near edges of flat sections.

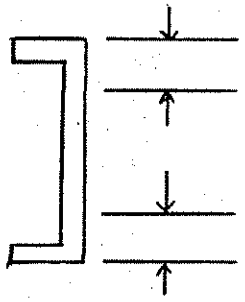
3. HOLE DRILLING

In general, frame rails are not to be drilled or otherwise perforated by holes without specific authorization by Engineering, normally in the form of a frame drilling chart.

A single exception to the rule, however, is that drilling of holes through the web of the channel (for tubing clips and the like) is permitted, providing the edge (not the center) of the hole is no closer than:

A. 3.00 from outer face of flange for aluminum rails. See note below.
B. 1.50 from outer face of flange for steel rails.

Holes may be drilled beyond the above state limits, or through the flange of the channel, only with Product Engineering approval.



NOTE: With aluminum rails, the shop has the following options in mounting tubing clips and the like:

1. Drill a #7 (.201 Dia.) hole and use a ¼-20 x ½ self tapping hex head bolt (such as 23-10172-050).

2. Drill a .281 Dia. hole and use a ¼ x 20 x 1 bolt and a nut.

NOTE: See 33-00109 for use of weld studs on steel rails.

COMPILED	H. OWEN	SHOP PRACTICE FRAME INSERT DRILLING AND CUTOUTS	SECTION NUMBER 33-15108
APPRV	H. OWEN		
ISSUE DATE	01/30/84		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0015-007 FOR FRAME INSERT DRILLING AND CUTOUTS PROCEDURE.

Compiled	H. OWEN	SHOP PRACTICE FRAME INSERT DRILLING & CUTOUTS	33-15108
Approved			
Issued	1-30-84		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

1. Drilled Frame Rails

   a. After the main frame rail is drilled, locate the insert in the main rail using information from the vehicle frame chart. Clamp the insert securely in place.

   b. Backdrill the frame insert using the main frame rail as a drilling template.

   c. The insert must be trimmed to match the main frame rail in cutout areas. Use the main frame rail cutout as a layout template for marking the insert. A light scribe line is preferred for marking to ensure accuracy. Make sure the insert is removed from the main frame rail for cutting and shaping. Material removal from inserts must be done in strict conformity with 33-15107 frame shaping procedures.

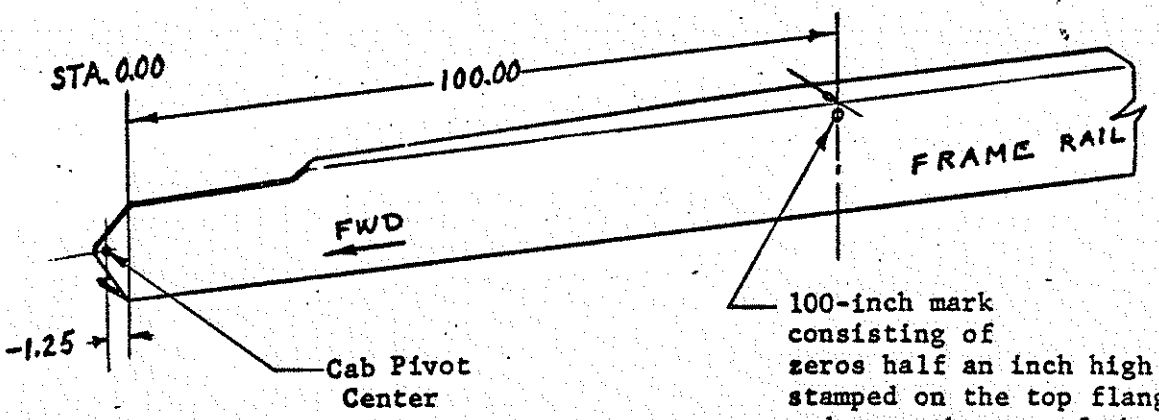
2. Punched Frame Rails

   a. Follow the procedures listed above for drilled frame rails.

   b. Option: The frame inserts may be punched on the frame rail punching machine, however, a new hole punching tape and/or machine set-up modifications will be required. Follow the same procedures listed above for insert cutout treatment.

Engineering Manual

Compiled	H.J.R.	SHOP PRACTICE	33-15110
Approved	G.H.A.	LOCATING COMPONENTS FROM FRONT OF FRAME	
Issued	5-26-66	FREIGHTLINER CORPORATION	
Revised	9-10-76	Chng Ltr: A PORTLAND, OREGON	



A

FRAME "STATIONS"

All locating dimensions along the frame are referred to "station zero", usually written 0.00". Station zero is not the extreme front of the frame rail, but a short distance behind it (1.25 aft of cab pivot hole). Station zero is usually quite inaccessible and thus not very useful after the vehicle is assembled. For this reason "station 100" is marked on each frame rail exactly 100 inches aft of "station zero" (see sketch); this mark can be used for all necessary locating purposes.

A NOTE: On aluminum rails, mark the 100-inch station using a drill point impression approximately 1/16 inch deep. This method of marking the 100-inch station is necessary on aluminum rails due to the critical surface stresses which could be the starting point for frame failure if the stamped marking were to be used.

COMPILED	L F	SHOP PRACTICE VEHICLE IDENTIFICATION NUMBER FRAME STAMPING CORRECTIONS	SECTION NUMBER 33-15114
APPRV	D WELKER		
ISSUE DATE	04/07/81		PAGE 1 OF 1
REV DATE	07/30/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0015-008 FOR VEHICLE IDENTIFICATION NUMBER FRAME STAMPING CORRECTION PROCEDURE.

COMPILED	L.FORNSHELL	SHOP PRACTICE VEHICLE IDENTIFICATION NUMBER FRAME STAMPING CORRECTIONS	SECTION NUMBER 33-15114
APPRV	D.WELKER		
ISSUE DATE	04/07/81		PAGE 1 OF 2
REV DATE	02/14/92	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		P6311F-01

PROCEDURE FOR MAKING CORRECTIONS TO VEHICLE IDENTIFICATION NUMBER.

1. STAMP OVER THE INCORRECT NUMBER OR LETTER. USE UPPER CASE CHARACTERS 6MM TO 13MM (1/4 TO 1/2 INCH) HIGH.

2. STAMP THE CORRECT NUMBER OR LETTER ABOVE OR BELOW THE INCORRECT ONE.

3. MARK WITH THE SPECIAL BLOCK "F" STAMP PURCHASED FOR THIS PURPOSE IN FRONT OF AND BEHIND THE I.D. NUMBER.

4. EXAMPLES:

INCORRECT: A B C D 2 9 7 6 6 6 2 4 9 4 5 6 7

CORRECTED: [F] A B C D 2 9 7 6 ~~6~~ 7 6 2 4 9 4 5 6 7 [F]

OR

[F] A B C D 2 9 7 6 ~~6~~ 7 6 2 4 9 4 5 6 7 [F]

5. IF 3 OR MORE NUMBERS OR LETTERS ARE INCORRECT, STAMP OVER THE ENTIRE I.D. NUMBER AND RESTAMP THE CORRECT NUMBERS BELOW. MARK WITH THE SPECIAL STAMP IN FRONT OF AND BEHIND THE I.D. NUMBER.

   NOTE: THIS IS AN ACCEPTABLE ALTERNATE METHOD IF LESS THAN 3 NUMBERS OR LETTERS ARE INCORRECT.

6. RECORD THE CORRECTION ON TWO "VIN CORRECTION NOTICE" FORMS. REFER TO PAGE #2 FOR A SAMPLE OF FORM "OA-230".

6.1 PLACE ONE COPY IN THE TRUCK FOLDER.

6.2 SEND ONE COPY TO WARRANTY.

V.I.N. CORRECTION NOTICE

DATE: _____ SERIAL NUMBER: _____

TO: CORPORATE WARRANTY RECORDS DEPARTMENT

CC: QUALITY ASSURANCE DEPARTMENT SERIAL NUMBER FOLDERS

TO WHOM IT MAY CONCERN

THE ABOVE SERIAL NUMBERED UNIT HAD THE VEHICLE IDENTIFICATION NUMBER STAMPED INCORRECTLY ON RH ☐ LH ☐ FRAME RAIL(S).

THE INCORRECT NUMBER WAS: _____

THE CORRECTED NUMBER IS: _____

THE V.I.N. WAS CORRECTED BY XING OUT THE _____

_____

_____

REPAIRED BY: _____

LOCATION: _____ VERIFIED BY: _____

ORIGINAL: SERIAL FILE
COPY TO: BERT IVEY CIA-ADS

SAMPLE

COMPILED	HERZIG
APPRV	D ROOHELA
ISSUE DATE	09/18/81
REV DATE	07/29/96
CHG LTR	A

SHOP PRACTICE

FRAME WARNING LABEL

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-15115

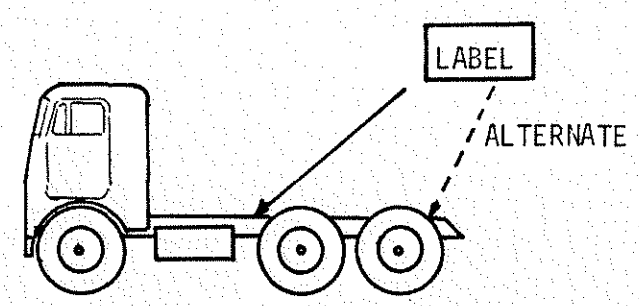
PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0015-009 FOR FRAME WARNING LABEL INSTALLATION PROCEDURE.

Compiled	Herzig	SHOP PRACTICE	33-15115
Approved	D. Ruuhela	FRAME WARNING LABEL	
Issued	9-18-81		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

LOCATION

1. See illustration below for preferred and alternate locations. One label per rail.



2. Label to be in same position LH and RH.
3. Top edge of label should be 1.50 ± .50 below top of frame, and level.
4. Shift location to avoid obstructions, bolts and holes.

APPLICATION

1. Apply label before chassis paint.
2. Peel off split backing and press hard, working out the bubbles.
3. After paint is dry, peel off surface mask, and expose label.

COMPILED	E R K	SHOP PRACTICE WELD STUDS- FRAME RAIL PERMISSIBLE AREAS	SECTION NUMBER 33-15116
APPRV	P R HHELA		
ISSUE DATE	08/30/93		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0015-010 FOR WELD STUD INSTALLATION PROCEDURE.

Compiled	F.FREER	SHOP PRACTICE SUSPENSION, CONTENTS	33-16100
Approved			
Issued	04/07/65		
Revised	07/21/88	Chg Ltr P FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-38

PRACTICE NO.	DESCRIPTION
33-16101	SUSPENSION INSTALLATION, REAR, FREIGHTLINER
33-16102	SUSPENSION INSTALLATION, REAR, HENDRICKSON
33-16103	AIR SUSPENSION INSTALLATION, REAR, NEWAY
33-16105	SUSPENSION INSTALLATION, REAR, REYCO
33-16106	BUSHING & PIN INSTALLATION, KAISER
33-16108	AIR SUSPENSION INSTALLATION, REAR, FREIGHTLINER
33-16109	TORQUING SCREW FASTENERS
33-16110	SHACKLE ANGLE & CLEARANCE
33-16201	SUSPENSION INSTALLATION, FRONT

COMPILED	H J R
APPRV	ANDERSEN
ISSUE DATE	10/15/85
REV DATE	07/29/96
CHG LTR	A

SHOP PRACTICE

SUSPENSION INSTALLATION, FREIGHTLINER

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-16101

PAGE
1 OF 1

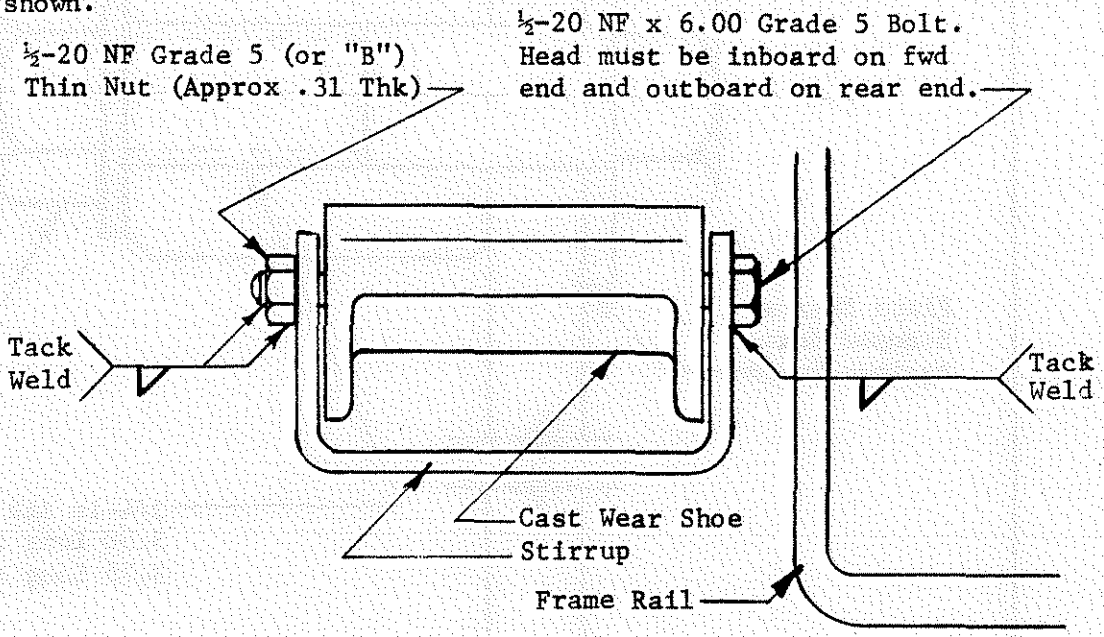
PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0016-001 FOR FREIGHTLINER SUSPENSION INSTALLATION PROCEDURE.

FREIGHTLINER EQUALIZER STIRRUP INSTALLATION

The spring-retaining stirrup of the equalizer must be installed so that it will swing freely on its pivot bolt.

Position the bolt head toward the frame rail on the forward end of the equalizer as shown in the sketch, and bolt head away from the frame on the rear (opposite to sketch), and fasten by tack welding three places as shown.

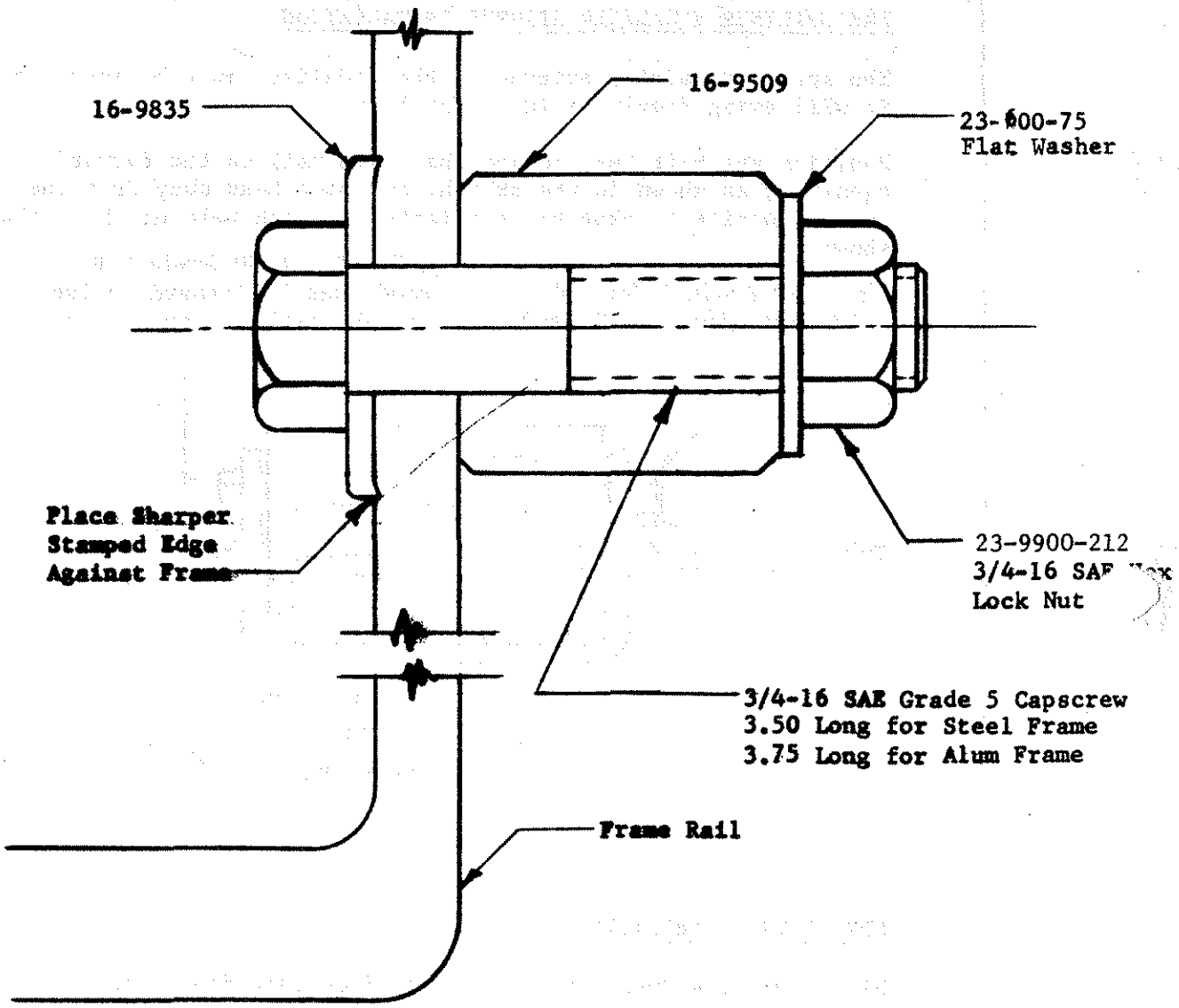


SPRING TIP LUBRICATION

Single Drive & Dual Drive With Wear Shoe Type Equalizer

Lubricate with chassis grease all spring tips on single or dual drive suspensions when they bear on stationary wear shoes either in frame brackets or in equalizers.

FREIGHTLINER EQUALIZER STOP INSTALLATION



V-BELT DRIVE INSTALLATION

Radius rods for the axles of a V-Belt Drive Suspension are to be selected and installed as follows:

A. Drive Axle
Use two (2) standard fixed radius rods and shim for adjustment.

Align the drive axle before adjusting the dead axle.

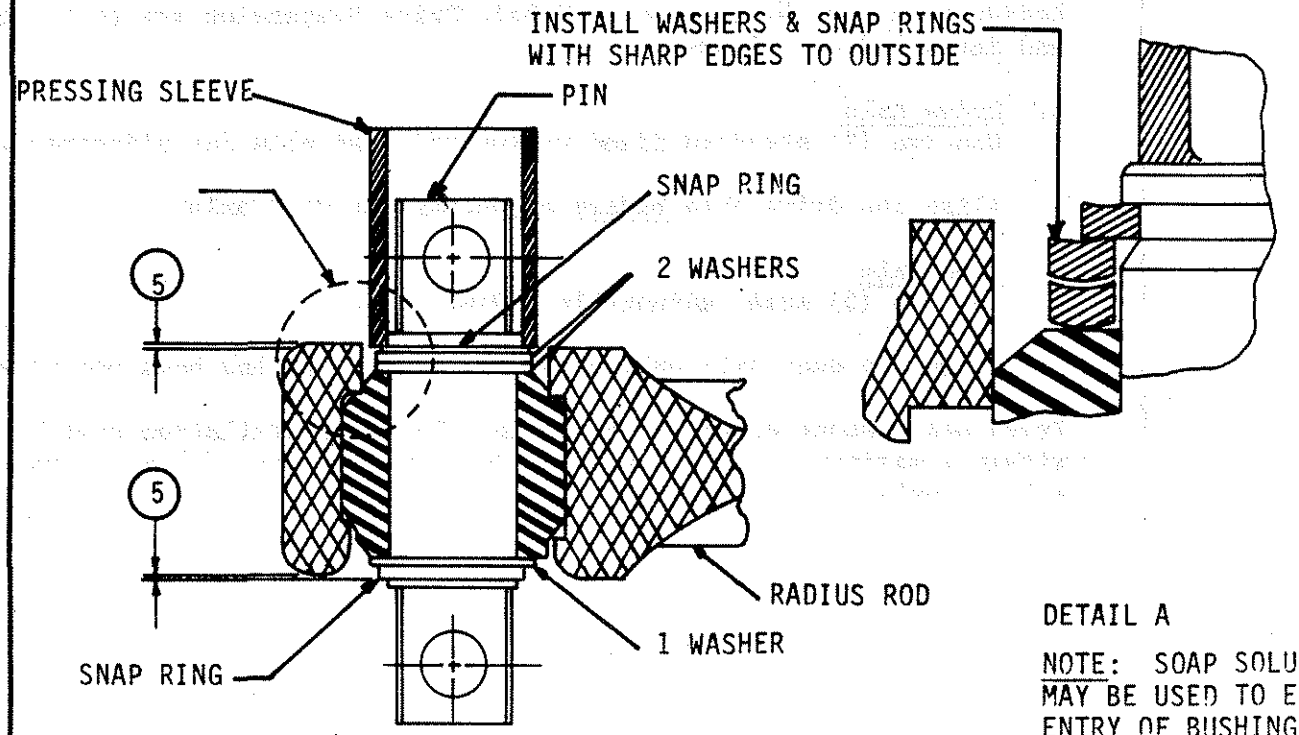
B. Dead Axle
Use two (2) steel adjustable radius rods.

Align the dead axle only after the drive axle has been properly adjusted.

Track measurement of axles paired in a V-belt installation must be equal within a maximum of 1/4" per side, for a maximum of 1/2" total variance from axle to axle.

RADIUS ROD INSTALLATION

INSTALLATION OF PIN WITH SNAP RINGS



DETAIL A

NOTE: SOAP SOLUTION MAY BE USED TO EASE ENTRY OF BUSHING INTO RADIUS ROD

1. Put a snap ring (Ref. TRU 5160-131) and washer (Ref. 11-9579) on the pin (Ref. 11-9448), being careful that the sharp edge of the washer and of the snap ring face outward, and that the snap ring seats properly all around.

2. Press the pin into the bushing from the same side as the bushing was inserted into the socket. (Do not lubricate the pin; it should be clean and dry.) Then rap pin with a hammer to insure correct positioning of pin.

3. With the pin pressed into the bushing put two washers (if required), sharp lips turned outward, onto the other end of the pin.

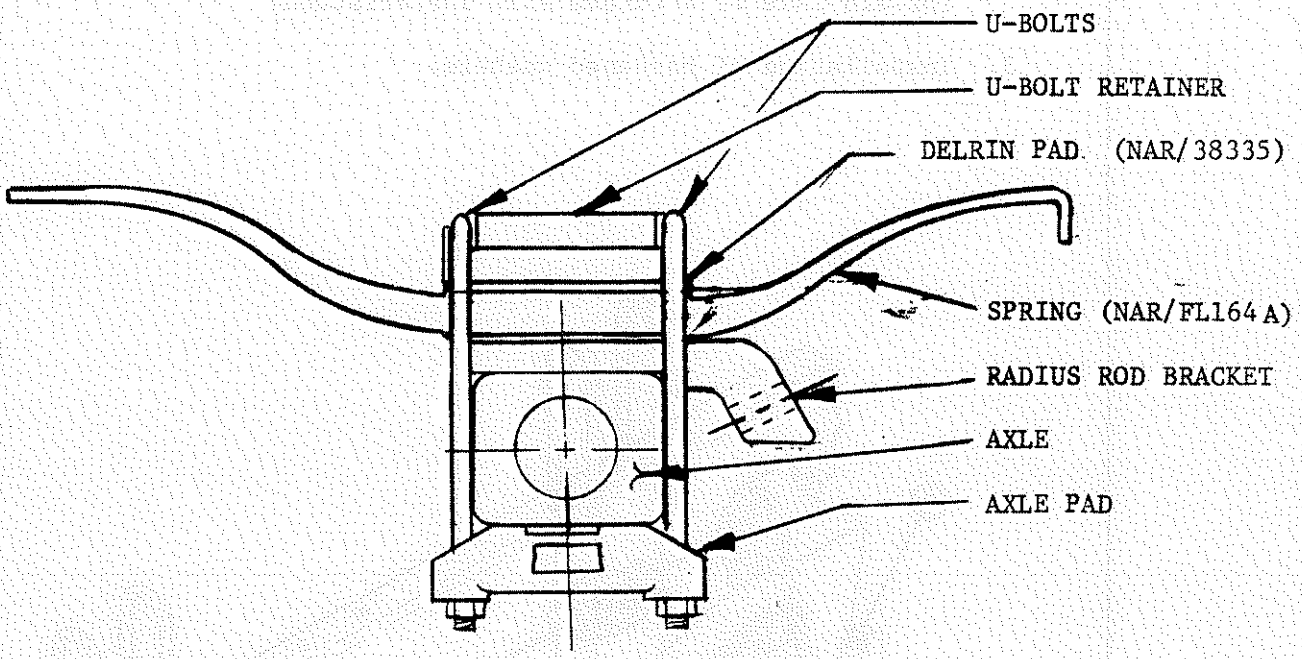
4. Place the second snap ring, with sharp edge outward, carefully onto the outer (bevelled) shoulder of the pin and, with a suitable sleeve, press the ring down until it snaps into its slot. (There should be no side movement of the pin.)

5. Finally, after assembly, center the pin in the radius rod end with the press.

* That is, if Step 4 cannot be accomplished, it may be necessary to try pushing the pin again in the initial position (Step 2) to reach the desired placement so that two washers can be used. If this is done and the second snap ring will still not seat readily in its slot, a single washer may be used.

(NAR) SPRING (Ref. NAR/FL164)

Install one pad (furnished taped to each spring) between spring and u-bolt retainer. (See sketch).

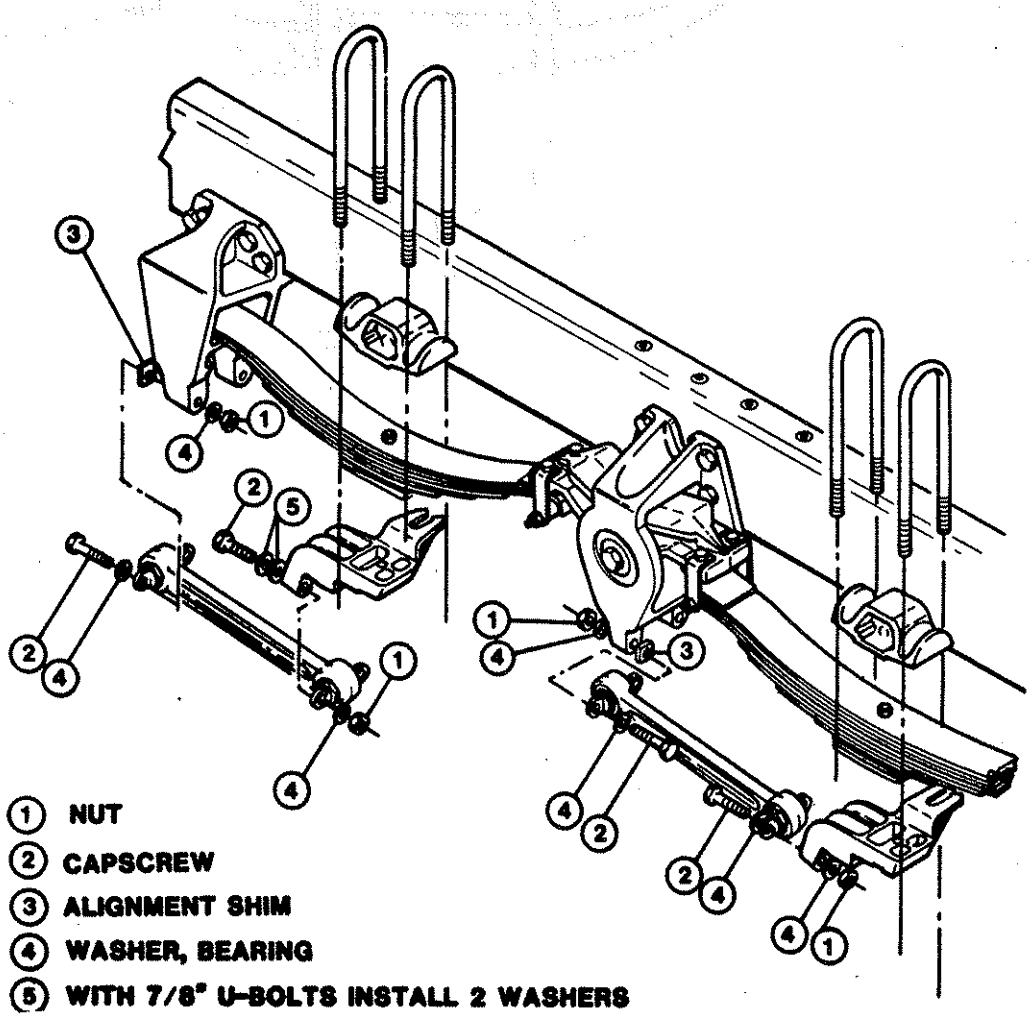


RADIUS ROD INSTALLATION

1. The radius rod assembly may be installed in any position.

2. Wedge brakes require the radius rod to be rotated 90° into position due to brake tube interference on single axle installations and on the forward axle of a tandem axle installation.

3. Installation of hardened washers:



① Adapted from "Balance" Vol. 2, No. 3, Page 11 - Published by Hendrickson Mfg. Co., Lyons, Ill.

HENDRICKSON 34000 & 38000 LB. SUSPENSIONS

1. Rubber-Bushed Beam Ends ①

The installations will insure a clamping effect of the axle bracket legs to the inner tube of the beam ends (rubber-bushed) when proper torque is applied. However, a metal-to-metal wearing condition and resulting road failure can occur if this is not done correctly at installation and periodically checked in service for proper torque.

The installation shown in Figure 1, is for use with centered axle bowls where the inboard end of the bore is accessible for insertion of a flanged adapter. The second installation (Figure 2) covers the case in which the inboard end of the bore is not accessible for insertion of the flanged adapter because of its proximity to an offset axle bowl. In this case a grooved adapter and lock-ring are used.

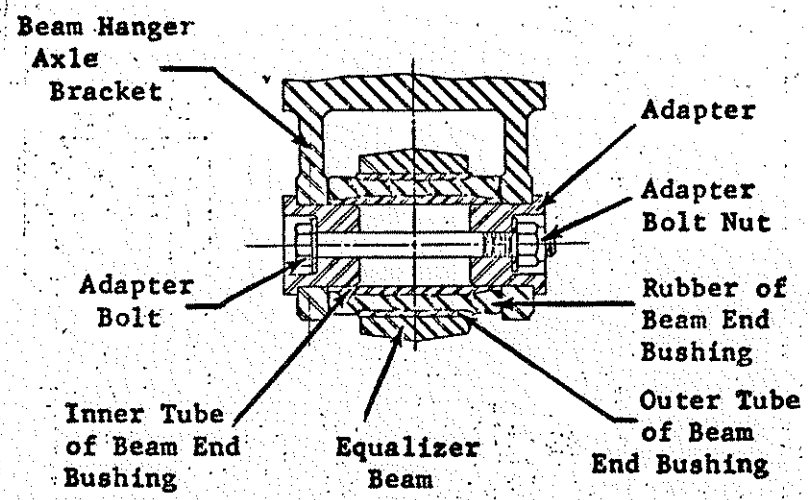


Figure 1A

The flat on the adapter flange must be in the vertical position as shown in Figure 1-B when adapter nut and bolt assembly is secure. This flat section is required for housing bowl clearance.

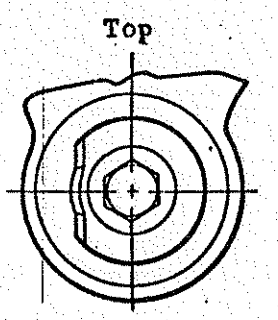


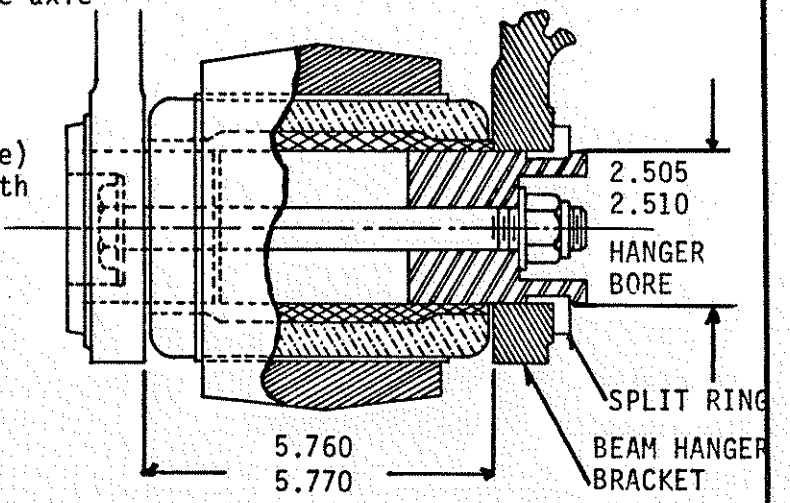
Figure 1B

A. Flange-Type Adapter Installation.

1. Remove dust shield.
2. Raise beam end to mounting position.
3. Insert lange type adapter plugs from both sides of the axle bracket.
4. With special hard washer under the head, insert the adapter bolt from the outboard side through both adapter plugs.
5. With another hard washer under the lock nut, tighten to recommended torque (per 33-16109, ref. 210-240 lb-ft). The inner tube of the bushing is clamped to the axle adapters against the outer surfaces.
6. Reinstall dust shield.

B. RETAINER-RING TYPE ADAPTER INSTALLATION

1. Remove dust shield.
2. Insert plug into the bushing in the beam, with the groove end of the plug toward the axle bow.
3. Raise the beam end into mounting position.
4. Install outboard beam end adapter plug (flanged type)
5. Start the adapter bolt with hard washer under the head through the outboard plug.
6. Install split ring, being sure it seats properly in its groove.
7. With split ring properly seated, push adapter bolt through inboard (grooved) plug, add hard washer and locknut, and tighten to recommended torque (per 33-16109, ref. 210-240 lb.ft.). The inner tube of the bushing is clamped to the axle bracket legs by pressure of the adapter bolt pulling the adapters against the outer surfaces.
8. Reinstall dust sheild.



2. HENDRICKSON SPACER WASHER FOR CONVERTING 38,000 BEAM HANGER BRACKETS TO 34,000

The AE-8531 Spacer Washer used to reduce the 5.75 opening in the 38,000# capacity Beam Hanger Bracket to 5.25, must be welded to the Beam Hanger Bracket. This weldment will consist of four one-inch welds spaced 90° apart.

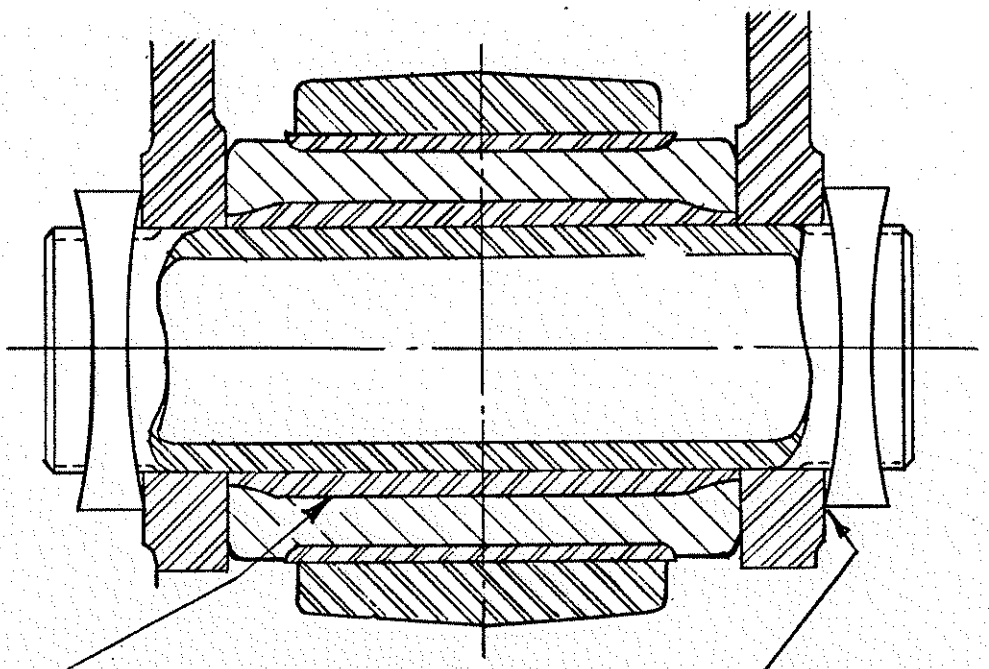
3. PLAIN TUBE & NUT BEAM-END ATTACHMENT

1. Lubricate threads with SAE-20 oil before assembly.

2. Center the tube in the Beam Hanger to ensure sufficient threads being available to tighten the nut.

3. Start the nut by hand and spin to assure proper threading to tube, then tighten to 375-425 ft.lbs. torque to create proper lock. (See figure Page 1.2)

3. PLAIN TUBE & NUT BEAM-END ATTACHMENT (Continued)



Inner tube of Beam End Bushing is prevented from turning on Beam End Tube by legs of Beam Hanger pressing against ends due to clamping action of the tube nuts.

Locking feature of nut is obtained by tendency of inner side to straighten as nut is forced against hanger.

4.

5. Beam Center Bushings

When rubber beam center bushings are used, thrust washers are not to be installed. The end play is eliminated by rubber compression when under load.

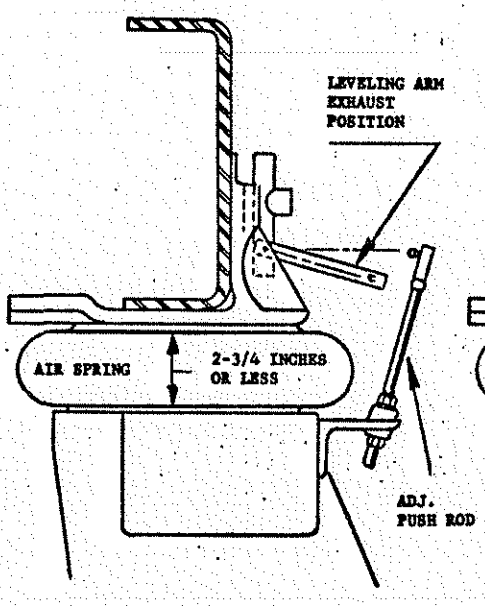
HENDRICKSON AIR SUSPENSION

Height Control Valve Adjustment

NOTE: VEHICLE AIR PRESSURE MUST BE 90 P.S.I. OR MORE TO START LEVELING VALVE ADJUSTMENT. ADJUSTMENT OF AIR SPRING CAN BE MADE WHEN UNIT IS IN A LOADED OR UNLOADED CONDITION WITH THE ABOVE RECOMMENDED AIR PRESSURE.

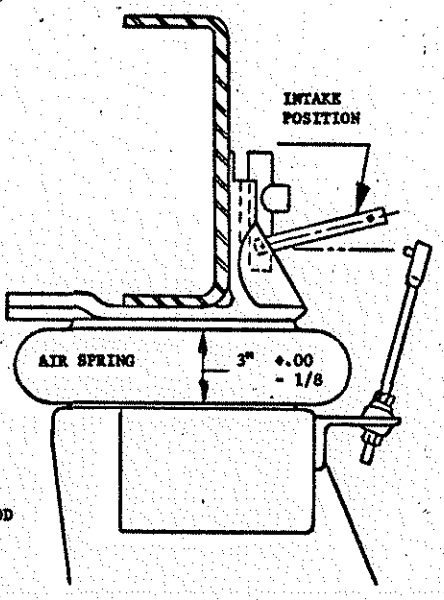
STEP 1.

DETACH PUSH ROD FROM LEVELING VALVE ARM AND BRING AIR SPRING HEIGHT DOWN TO 2-3/4 INCHES OR LESS.



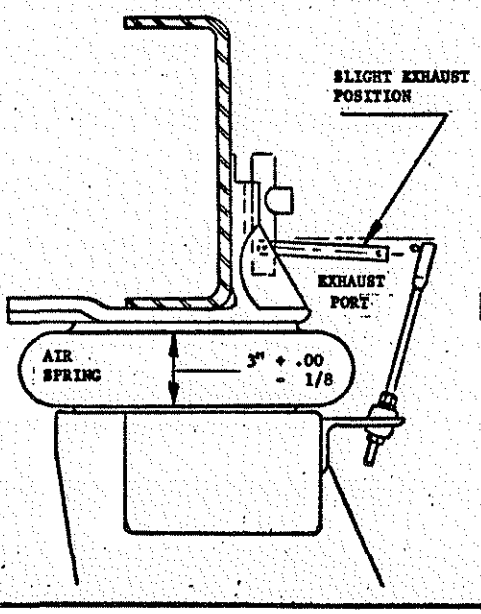
STEP 2.

RAISE VALVE ARM UP TO INTAKE POSITION UNTIL AIR SPRING REACHES A HEIGHT OF 3 INCHES.



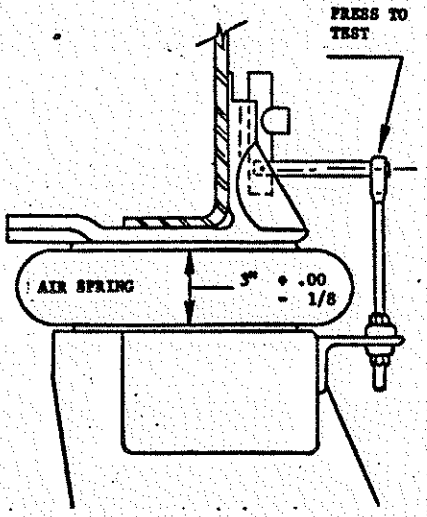
STEP 3.

BRING VALVE ARM SLOWLY DOWN UNTIL AIR STARTS EXHAUSTING FROM BOTTOM OF VALVE, IMMEDIATELY RAISE ARM UP JUST FAR ENOUGH TO STOP AIR EXHAUST.

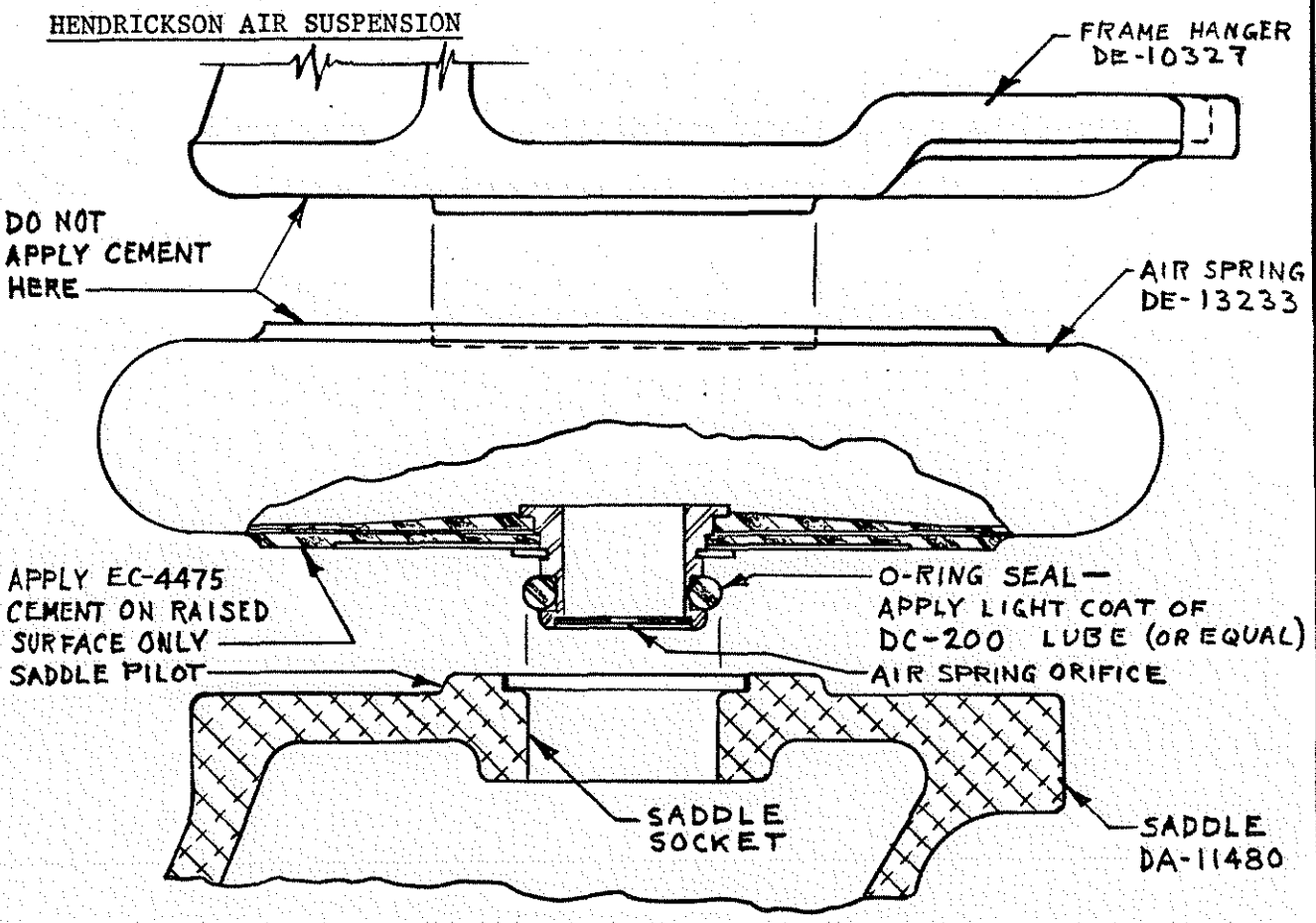


STEP 4.

ATTACH PUSH ROD BALL JOINT TO VALVE ARM IN THIS POSITION. TO CHECK IF ADJUSTMENT IS CORRECT - PRESS DOWN BY HAND ON TOP OF PUSH ROD, A SLIGHT AIR EXHAUST SHOULD TAKE PLACE, WHEN PRESSURE IS RELEASED EXHAUST SHOULD STOP.



From Hendrickson Mfg. Co., Lyons, Ill. Dwg. #13E-17730-29 Leveling Valve Adj. Diagram for BE 13695 (Bendix-Westinghouse) Dated 9-17-59.



Install Air Spring (Ref. HDR/DE-13233) between frame hanger and the saddle,

1. Be sure O-Ring Seal around outside of the air spring orifice is free of foreign matter and not damaged. Use a light coat of lubricant (Ref. DC-200) to aid in assembly.

2. The mating socket in the saddle must also be clean and smooth.

3. Apply a coat of cement (Ref. HDR/EC-4475, supplied with each suspension) to the air spring raised surface on the orifice side only. See sketch above.

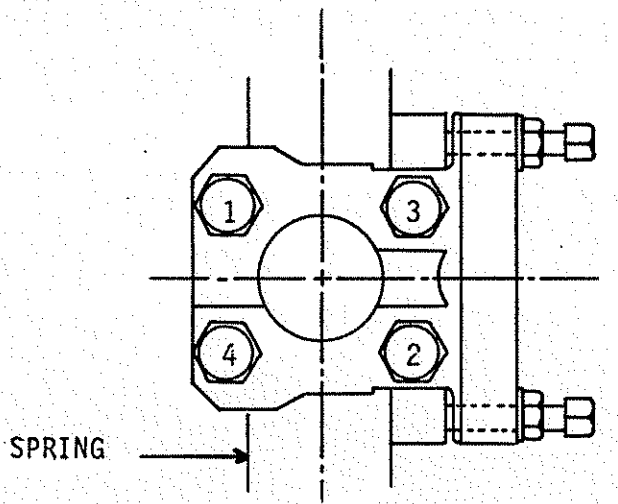
4. Press the air spring orifice into the saddle and rotate until the pilot fits into the air spring recess. CAUTION: No cement should be applied to the top of the air spring.

HENDRICKSON RTE, RTAE, UE, UEA, SUSPENSIONS

Axle stops are not required for the rear rear axle when the extended leaf 52.00" or 54.00" (axle spacing) suspensions are used. The extended leaves serve as a stop. The extended leaf 60.00" (axle spacing) suspensions do require axle stops as specified in the parts list.

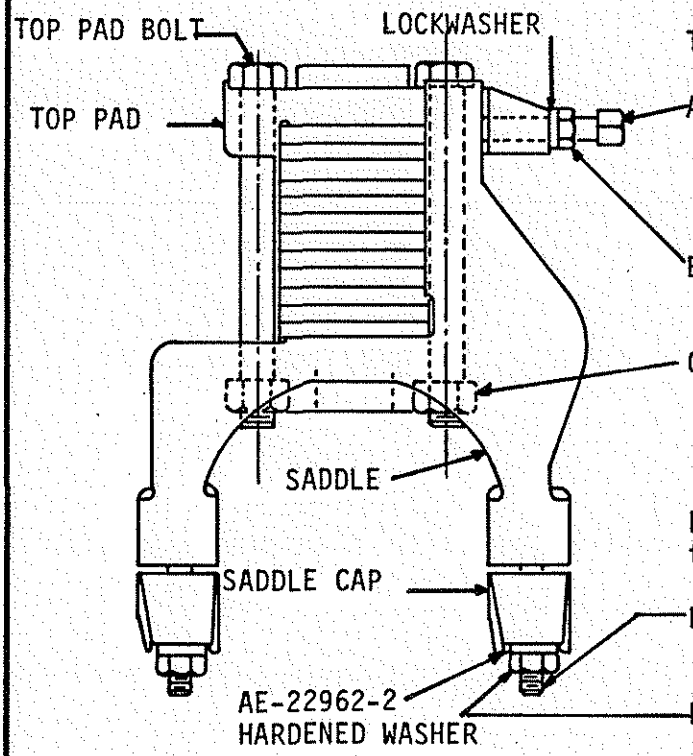
HENDRICKSON RT & RTE SUSPENSIONS

Tightening procedure for spring to saddle:



With spring located in saddle and top pad in place, insert four top pad bolts with nuts, and snug up nuts to hold assembly in place.

CAUTION: Lubricate all threads with SAE 20 oil before assembly. Axles must be in operating position before saddle caps are tightened.



Tighten as follows:

A. AE-6813 set screw, saddle top pad, tighten to 100 to 150 ft. lbs. torque. Tighten AE-6813 before tightening top pad bolts.

B. AE-17342 nut, top pad set screw, tighten until lockwasher is locked.

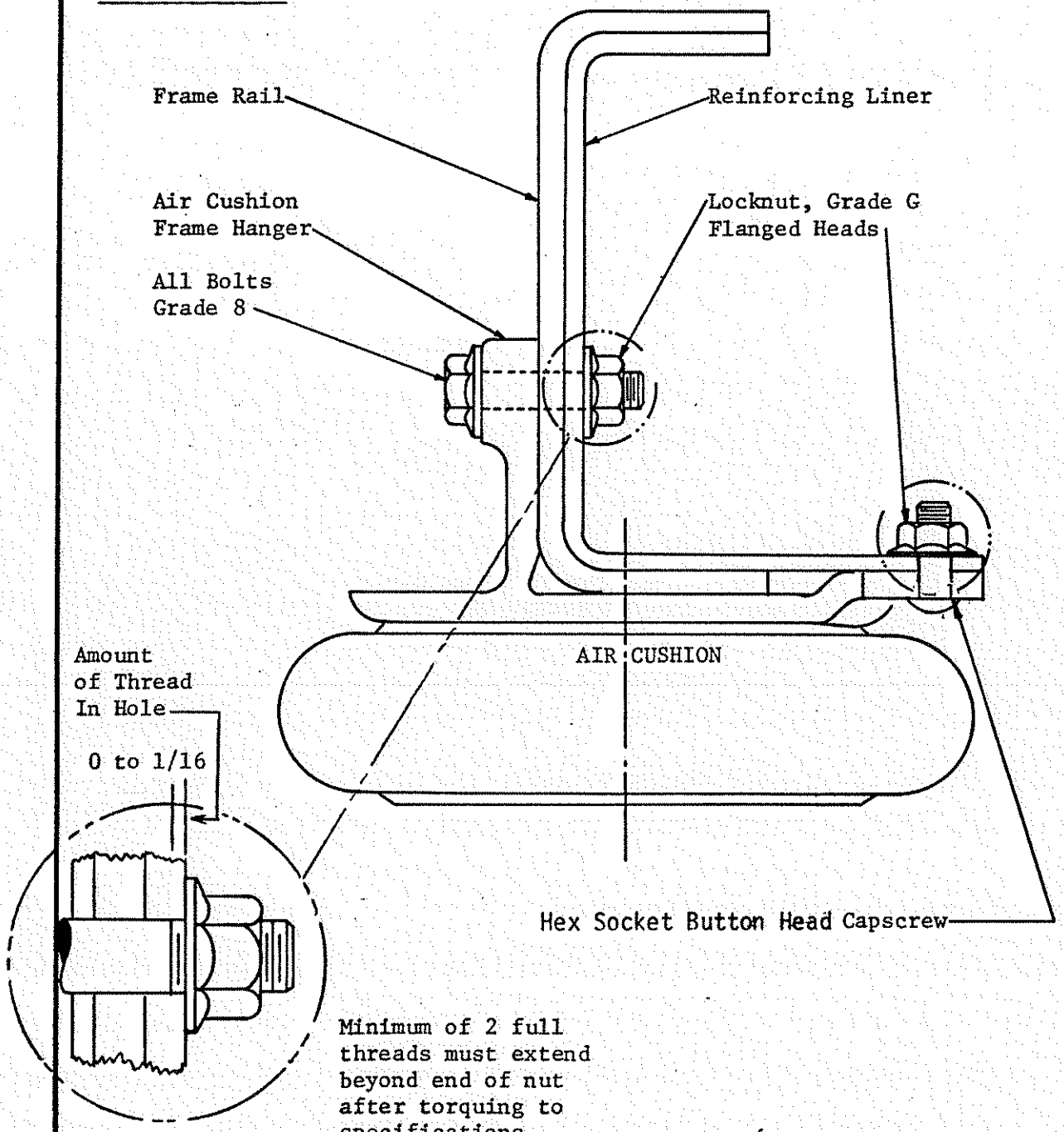
C. AE-8017 nut,saddle top pad nut,tighten to 275 to 300 ft. lbs. torque per tightening sequence 1, 2, 3, 4 as shown above. B

Lower saddle cap studs and nut tightening torque.

D. AE-6696 stud, saddle cap tighten to 55 to 65 ft. lbs. torque.

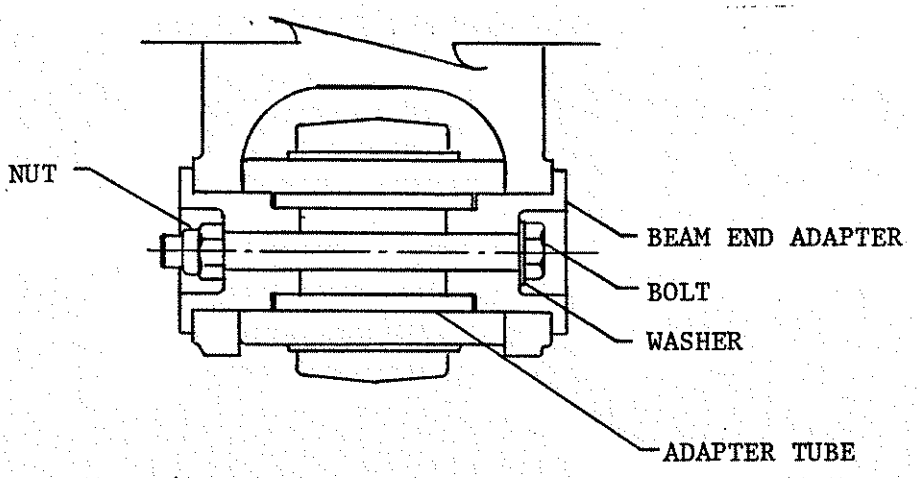
E. AE-4842 nut, saddle cap, tighten to 225 to 275 ft. lbs. torque. B

AR SERIES INSTALLATION OF FRAME HANGER
FOR AIR SPRING

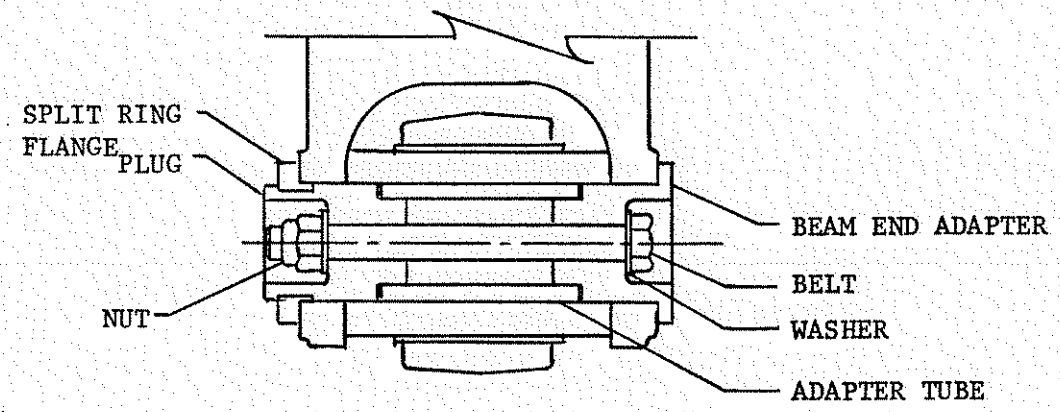


Minimum of 2 full threads must extend beyond end of nut after torquing to specifications. (Ref 33-16109)

HENDRICKSON SUSPENSION FOR ROUGH SERVICE APPLICATION



45000-7 ADAPTER KIT



45000-B ADAPTER KIT

NOTES:

A

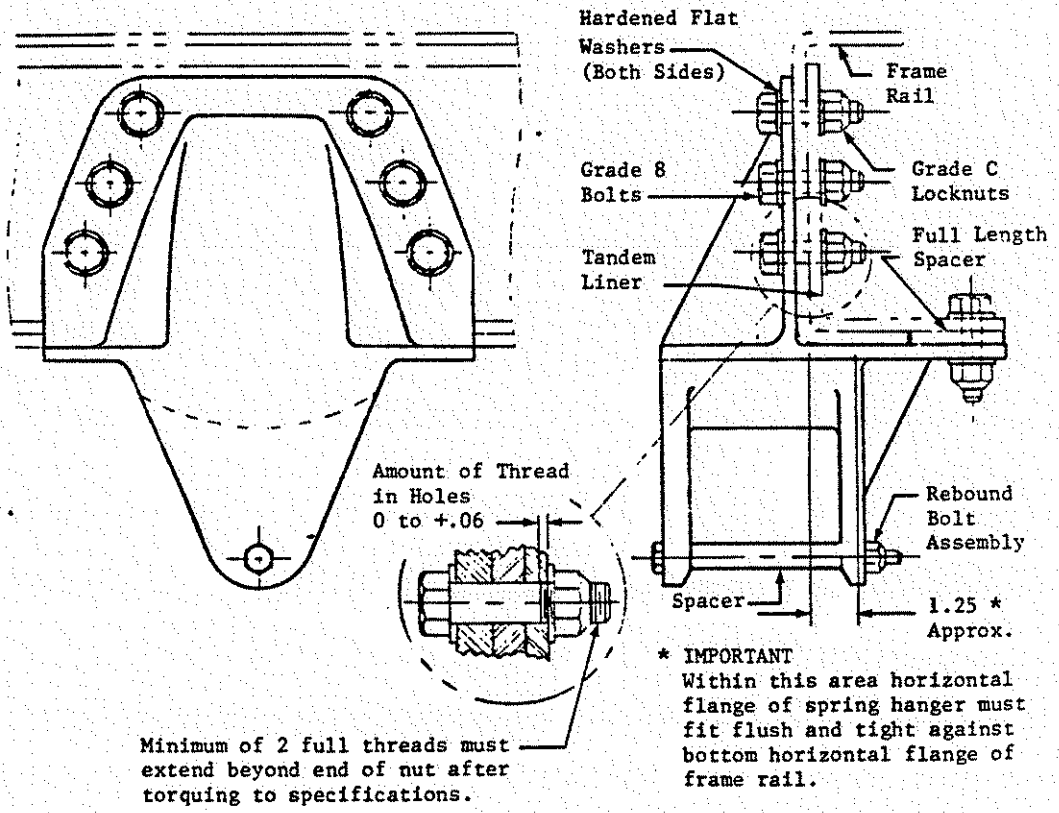
1. The flat on the beam end adapter flange must be in a vertical position when the nut & bolt assembly is secured.
2. Before assembly rust preventative must be applied to all parts that have a mating surface.
3. For assembly of HDR/17700-15 locking nut (cadmium plated) threads must be lubricated with S.A.E. 20 oil and nut tightened to 210 to 240 ft. lbs. torque. For assembly of HDR/30191 locking nut (cadmium plated) threads must be lubricated with S.A.E. 20 oil and nut tightened to 210 to 240 ft. lbs. torque. This is to insure clamping effect of beam hanger legs to inner tube of beam end bushing. Axles to be in normal operating position.
4. Quantities shown are for one beam end only.

A. INSTALLATION OF DOUBLE LOCK SPRING PIN

1. With the spring in place, insert the rebound bolt 24531-5 and rebound bolt spacer 194 into the hanger legs as shown with the bolt head on the outboard side.

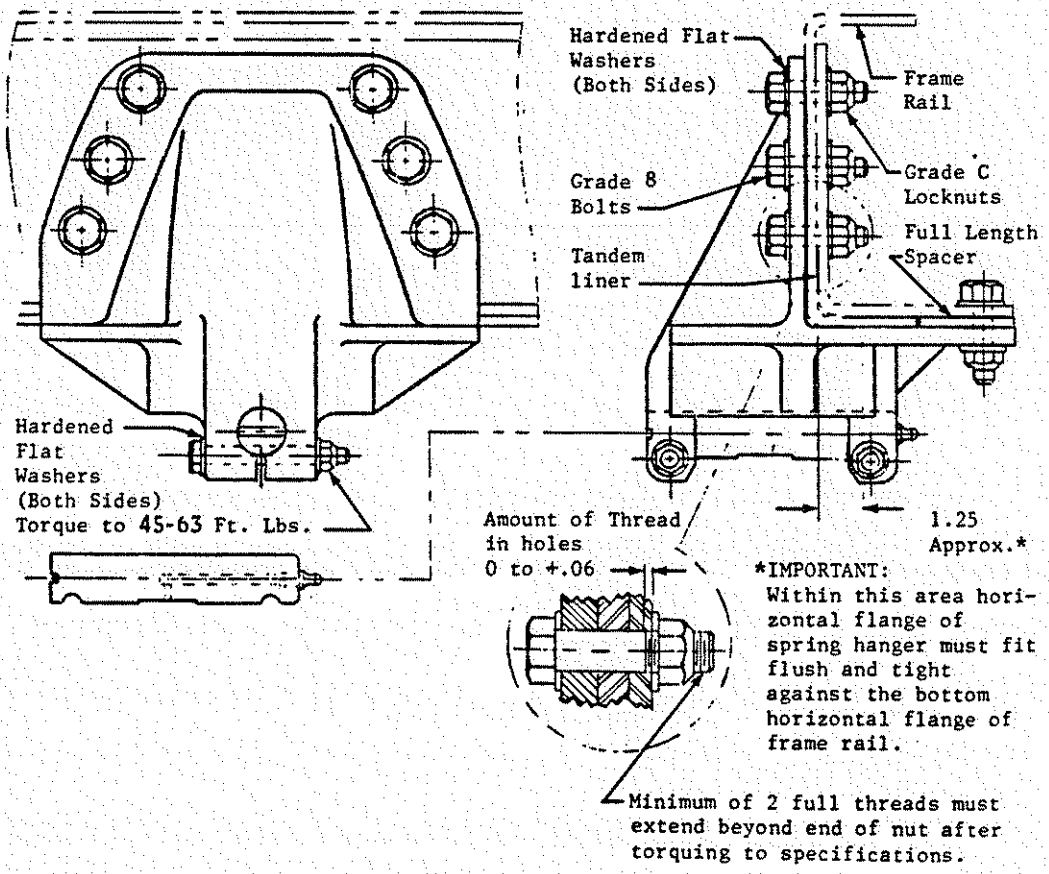
2. Tighten the 46578 locknut to 38-45 Ft.-Lbs. Torque.

NOTE: Rebound bolt assembly consists of rebound bolt (Part No. 24531-5), rebound bolt spacer (Part No. 194) and locknut (Part No. 46578).



B. INSTALLATION OF REBOUND BOLT ASSEMBLY

1. Lubricate I.D. of spring eye bushing and align with pin hole in spring hanger.
2. Coat spring eye pin with lube and pilot into outside hanger leg hole through spring eye bushing. Tap lightly (do not drive) moving the spring to ease entry of pin into hole of the inside hanger leg.
3. Rotate pin at slotted end to align the keyways with lock bolt holes.
4. Insert lock bolts with locknuts and flat washers.
5. Install lube fitting and pressure lubricate until lube appears on both sides of spring eye bushings. Use a good quality chassis grease at 10,000 mile intervals. Operation may require a more frequent lube cycle under severe conditions.



COMPILED	EGGIMAN	SHOP PRACTICE	SECTION NUMBER 33-16103
APPRV	HADDOCK		
ISSUE DATE	07/19/85	SUSPENSION INSTALLATION, NEWAY	PAGE 1 OF 1
REV DATE	07/29/96		
CHG LTR	C	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0016-002 FOR NEWAY SUSPENSION INSTALLATION PROCEDURE.

Compiled	A. SCHMUCKER	SHOP PRACTICE	
Approved	[illegible]	SUSPENSION INSTALLATION	33-16103
Issued	7-19-85	NEWAY AIR SUSPENSION	
Revised	12-14-87 Chg Ltr B	FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

1. HEIGHT CONTROL VALVE ADJUSTMENT

Adjust Height Control Valves for proper centerline-of axle to underside-of-frame distance on Neway by setting one valve at a time as follows:

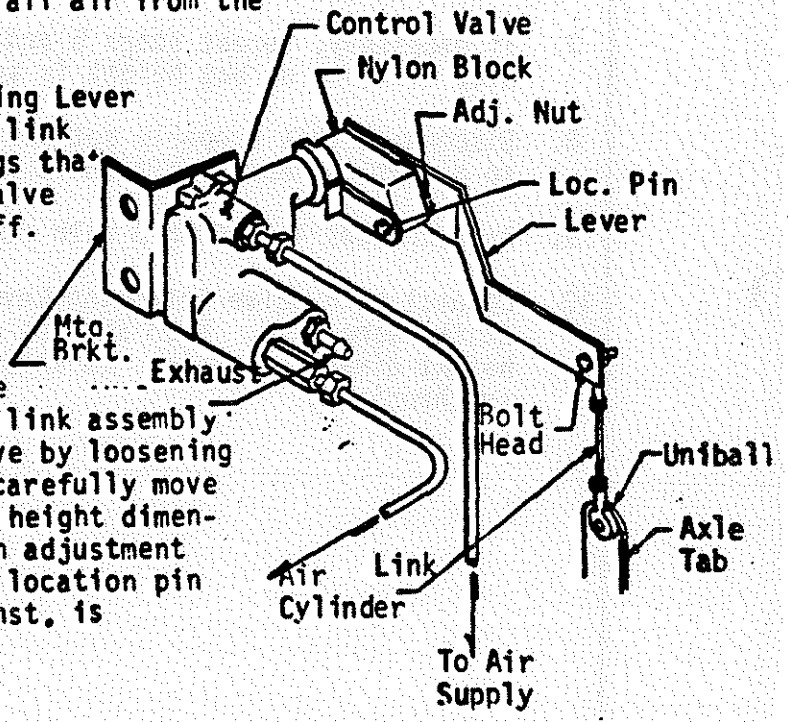
1. Position vehicle on level floor with engine running to maintain air pressure in excess of 70 p.s.i. while adjusting valves.

2. Disconnect both Height Control Valve Linkage Assemblies from the External Actuating Levers.

3. Move both Actuating Levers to a vertical down position to exhaust all air from the Air Springs.

4. Connect one Valve Actuating Lever only with its respective link assembly. Let Air Springs that are controlled by this valve fill until Valve shuts off.

5A. Neway
Measure distance from centerline of axle to underside of frame in the same area that valve and link assembly are located. Adjust valve by loosening adjustment lock nut and carefully move nylon block until proper height dimension is reached. Tighten adjustment lock nut. Do not remove location pin from nylon block until inst. is completed.



HEIGHT CONTROL VALVE ADJUSTMENT (cont.)

Where applicable, if more adjustment is needed, it may be obtained by lengthening or shortening the link with unibal ends of the Neway tag suspensions.

It will require from 2 to 6 seconds, after moving Nylon Block, before air starts to flow through Valve due to a built-in time delay.

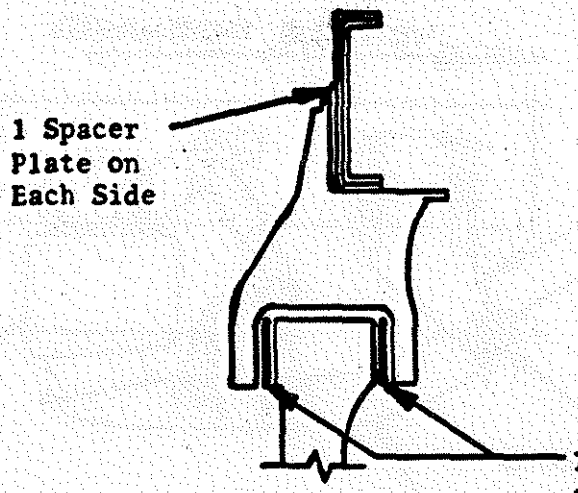
6. Disconnect Link Assembly again, and let Springs deflate about half way. Reconnect the Link Assembly to inflate Springs. When Valve shuts off, check height dimension again.

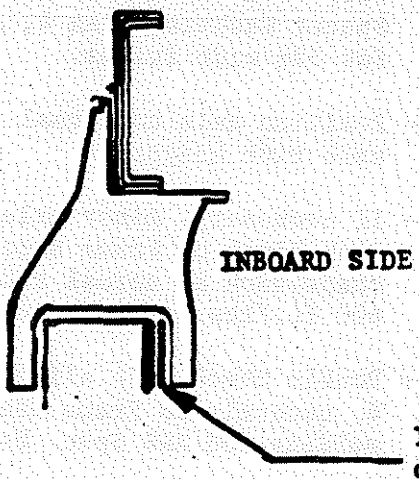
7. If necessary, repeat steps 5 and 6 until proper centerline of axle to underside of frame or bag height is accomplished.

8. Disconnect this properly set Height Control Valve and move Actuating Lever to a vertical down position to deflate Springs.

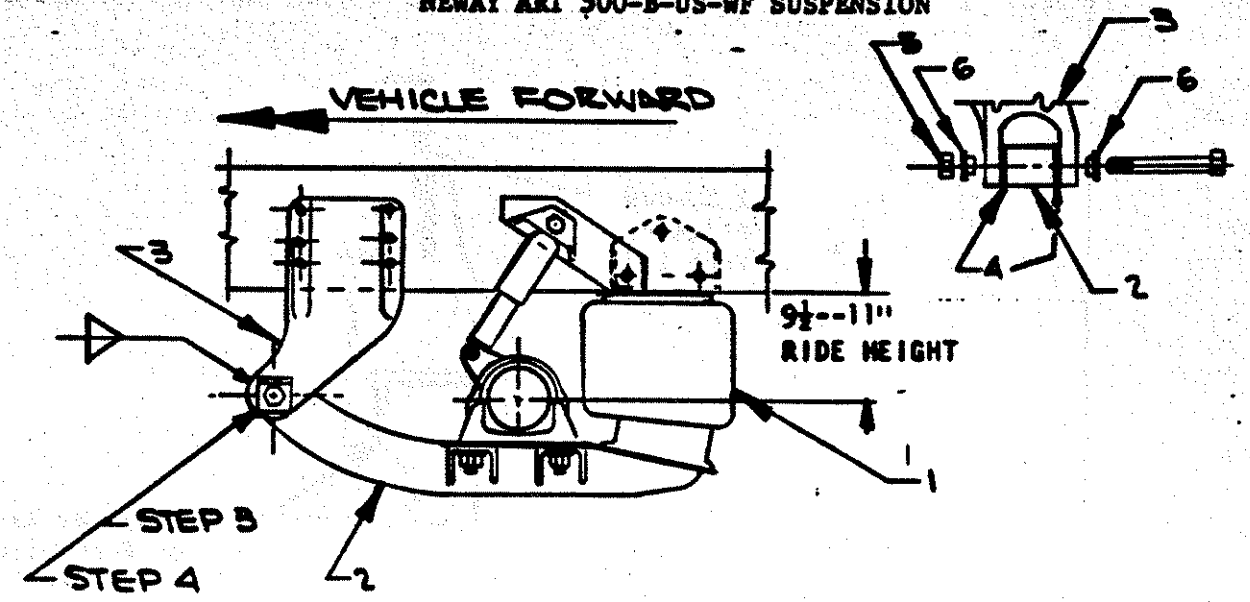
9. Repeat steps 4 through 8 with other Height Control Valve.

10. Connect both Valve Actuating Levers with their respective Link Assemblies at the same time. When Springs are fully inflated and Valve shut off, chec height dimension again. It should now be proper and both Valves synchronized.


1 Spacer Plate on Each Side
1 Spacer Washer on Each Side for 34" Frame Width


INBOARD SIDE
Install 2 spacer washers on the inboard side for 33½" frame width.

NEWAY ART 500-B-US-WF SUSPENSION



STEP 1 - Position Axle Assembly and secure Equalizing Beam, Item 2, to Frame Bracket, Item 3, as shown.

CAUTION - Nuts, Item 5, must be located on inner side of Bracket. Locate Spacer Washers, Item 4, as shown. For 34" frame width, see Page 3 for 33½ wide frames.

STEP 2 - Position axle to normal ride height. (Varialbe depending on drive axle ride height.)

STEP 3 - If necessary, minor axle alignment is achieved by shifting Alignment Block on Frame Bracket. After axle has been aligned, and with suspension at normal ride height, tighten nuts to a minimum of 600 ft./lbs. ± 60 torque lubricated.

STEP 4 - Double check axle alignment, then weld both Alignment Blocks, Item 6, securely to Frame Bracket inside and outside as shown. Use welding rod AWS Spec. E-7018 or equivalent.

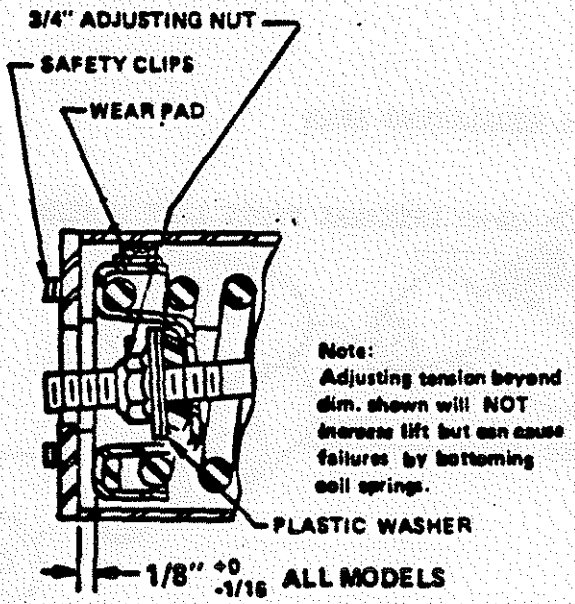
STEP 5 - Install Air Spring, Item 1, after all welding is completed and cooled. Do not weld Air Spring to Spring Mounting Plate. Tighten ½"--13 cap screws to 25 ft./lbs. ± 3 torque lubricated.

STEP 6 - Install Shock Absorbers, Item 7.

CAUTION - Be sure Shock Absorber is installed large end up. Torque nuts to 150--200 ft./lbs. lubricated.

DECAL: A decal showing coil spring adjustment is furnished with the suspension kit and should be installed as per D16-10407.

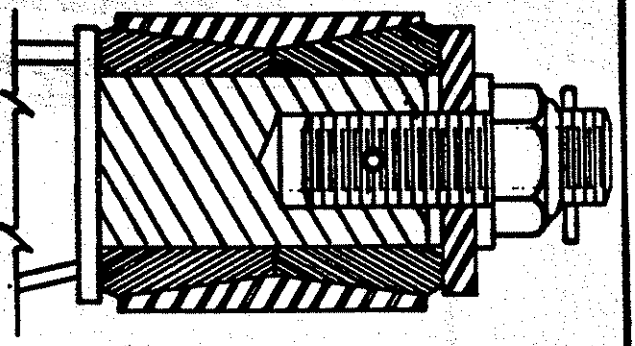
COIL SPRING LIFT: ART-505C,555 and AR955 suspensions are to have the coil spring adjusted as shown below.

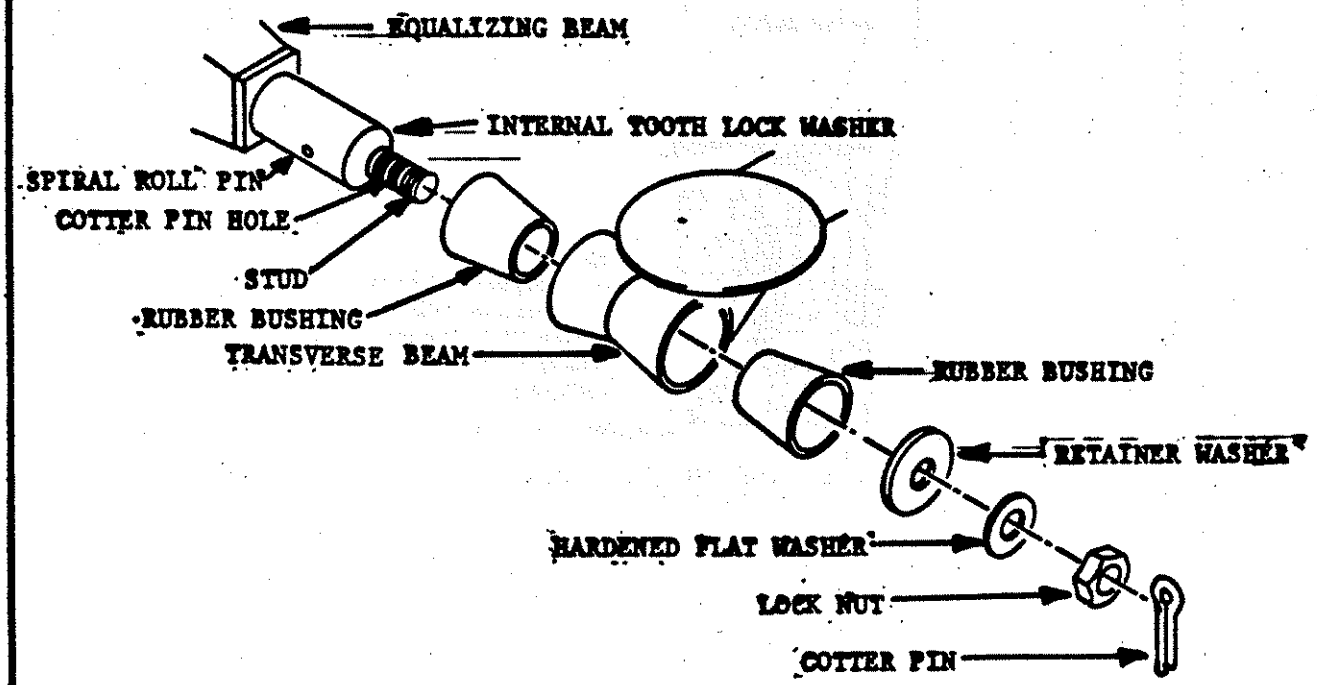


NEWAY ARD-125 & ARD-244 SUSPENSIONS
TRANSVERSE BEAM TO EQUALIZER BEAM

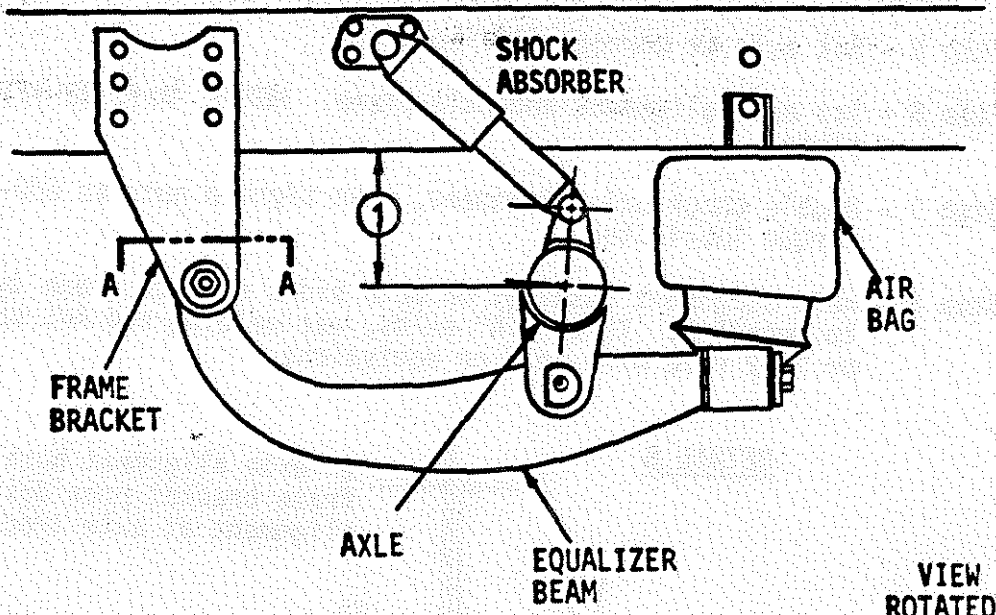
INSTALLATION

1. Assemble parts as shown.
2. Torque nut to 600-700 ft. lbs.
3. Insert cotter pin and spread the ends.

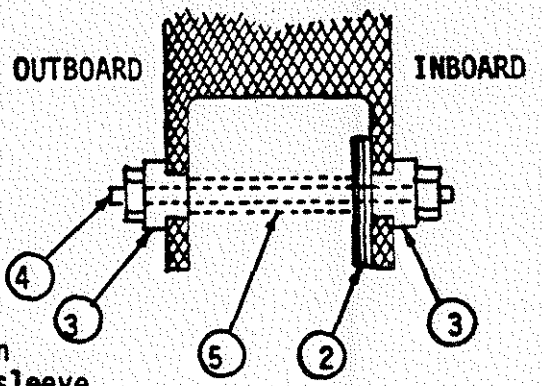




NEWAY ARD-125 & ARD-244 SUSPENSIONS



VIEW A-A ROTATED 90°



1. 10" ride height
2. Spacer washers
3. Alignment bushings
4. Pivot bolt
5. Inner sleeve

Step 1 - Install axle assembly on equalizer beam assembly.

Step 2 - Position equalizer beam assembly in frame brackets. Insert the inner sleeve into the equalizer beam bushing. Push the rod bolt into the frame bracket and at the same time insert the spacer washers.

Step 3 - Install shock absorber.

CAUTION: Be sure shock absorber is installed with large end up. Torque nuts to 150/200 ft. lbs. lubricated.

Step 4 - Install air bags, tighten 1/2-13 capscrews to 25 ft.lbs. torque lubricated.

B

Note: The flat on the beam end adapter flange must be in a vertical position when the nut and bolt assembly is secured.

5. continued . . .

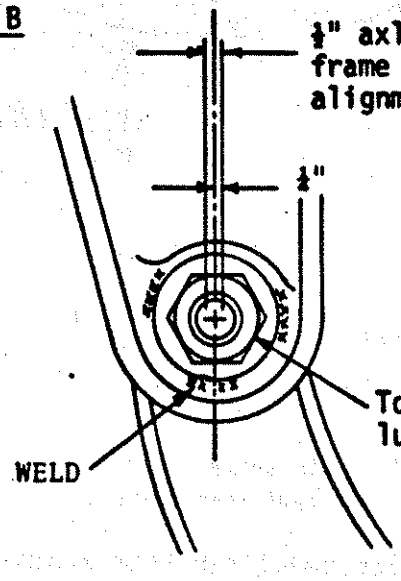
Step 5 - Set axle at correct ride height.

Step 6 - Set axle alignment and axle plane. NOTE: Ref. 33-11104 for axle plane.

Step 7 - Double check axle alignment, then tighten nuts to 600-700 ft.lbs. torque lubricated.

Step 8 - Weld alignment bushings on both sides of each frame bracket as shown in detail B. Three 3/4" welds, use welding rod AWS spec E7018 or 3/32 FC72 wire weld or equivalent.

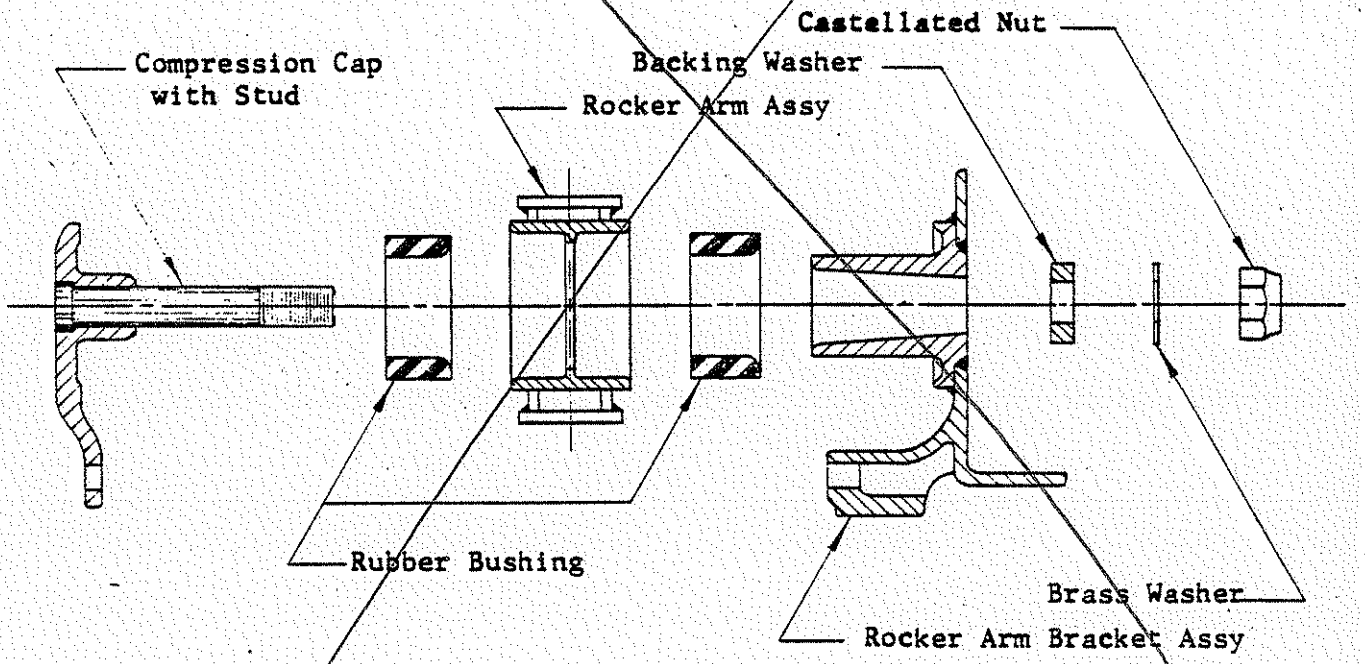
DETAIL B



PAGE & PAGE 700 & 800 SERIES
SUSPENSION

Special Assembly Precaution:

1. Rocker Arm Assembly - Be sure that the radius on the rubber bushings, Part No. PP496 is installed facing the inboard direction.



NOTE: Use water only to press rubber bushing in rocker arm assy and over rocker arm bracket assy. Definitely, do not use oil or grease of any kind.

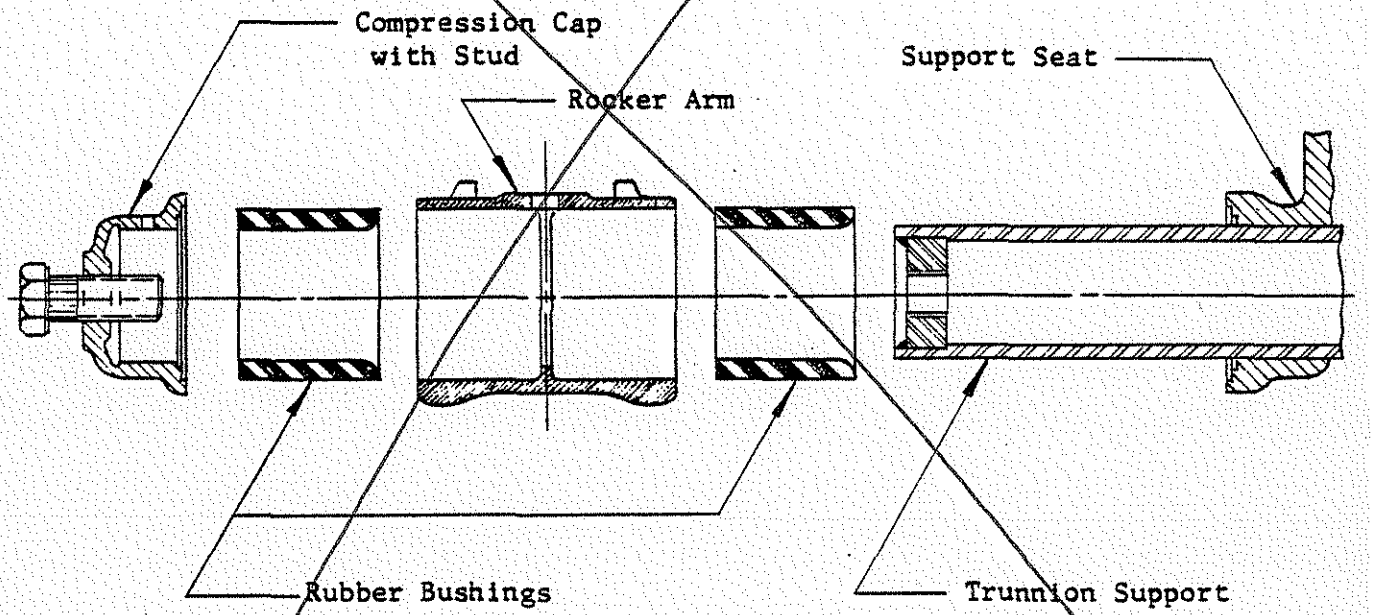
2. Adjustable Radius Rod Location - Assemble with one adjustable radius rod on forward, and one adjustable radius rod on rear axle--at opposite corners.

● Was 33-16101 p. 1.

PAGE & PAGE LWH SERIES SUSPENSION

Special Assembly Precaution:

Be sure that the radius on the rubber bushings, Part No. 1027162, is installed facing the inboard direction.



NOTE: Use water only to press rubber bushings in rocker arm and over trunnion shaft. Definitely, do not use oil or grease of any kind.

Was 33-16101 p. 2.

COMPILED	K. BUTZ	SHOP PRACTICE	SECTION NUMBER 33-16105
APPRV	JAKE		
ISSUE DATE	06/07/85	SUSPENSION INSTALLATION, REYCO	PAGE 1 OF 1
REV. DATE	07/29/96		
CHG LTR	B	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0016-003 FOR REYCO SUSPENSION INSTALLATION PROCEDURE.

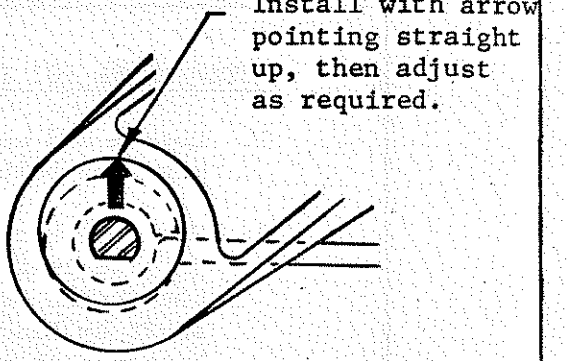
Compiled	K. BUTZ	SHOP PRACTICE	
Approved	JAKE	SUSPENSION INSTALLATION, REYCO	33-16105
Issued	6-7-85		
Revised	12-19-86 Chg Ltr A	FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

REYCO AXLE ALIGNMENT

TO MOVE AXLE FORWARD:
Turn bushing with arrow to the rear.

TO MOVE AXLE REARWARD:
Turn bushing with arrow to the front.

TOTAL AXLE MOVEMENT IS 7/16 PER AXLE.



REYCO MODEL 101A INSTALLATION

1. Locate and mount front, center, and rear spring hangers and torque all mounting bolts to 160-195 ft./lbs. (5/8" Grade 8.2 Fasteners).

2. With all hangers installed, insert equalizer casing (Note: "This side in") so that slot in rubber bearing sleeve engages the two lugs cast on the inside surface of the center hanger. Install threaded equalizer shaft by hand after applying anti-seize compound to threads. When shaft bottoms out against rail, back shaft out ½ turn. Install lockwasher and nut, then torque nut to 600 ft./lbs. ±60.

3. Put the spring (hook ends to the rear) and axle assemblies in place and retain with spring rollers, bolts, and nuts. Note: Front hanger requires a lockwasher under the bolt head and no nut. Rear hangers use bolt, lockwasher, nut spring roller, and rubber bushing. Equalizers require bolt, spring roller, lockwasher, and nut.

   Once springs and seats are properly positioned and aligned, torque U-bolt nuts and 300 ft./lbs. ± 25 (3/4" -16UNF Fasteners).

4. Using 10033-01 (7/8 x 5½") bolts and 10092-01 lock nuts, install appropriate end of rigid torque arms in axle seat torque arm pivot joints. Do not tighten this joint until the other ends of torque arms are installed in hangers. Note: On vehicles with 50" axle spacing, mount the (2) shorter rigid torque arms (11184-01) on the forward axle. Using T-1721 bolts, T-1723 eccentric bushings, T-1724 washers, and T-1722 locknuts, install the other ends of torque arms in their respective hanger torque arm joints with the ARROW on the T-1723 eccentric bushings pointed up. Snug joints only as alignment will be accomplished when the installation in completed. The ARROW also shows on head of T-1721 bolt.

5. When both ends of torque arms are installed in their respective joints, tighten nuts at axle seat torque arm joint to 250 ft./lbs. ± 20 torque.

6. Align suspension and tighten hanger torque arm joints to 160 ft./lbs. ± 10, of torque. After axle alignment, tighten U-bolts to 300 ft./lbs. ± 25 torque.

REYCO MODEL 102 INSTALLATION

1. Locate and mount front, center, and rear spring hangers, and tighten all mounting bolts to 165-195 ft./lbs. (5/8" Grade 8.2 Fasteners).

2. With all hangers installed, insert equalizer casting (Note: "This side in") so that slot in rubber bearing sleeve engages the two lugs cast on the inside surface of the center hanger. Install threaded equalizer shaft by hand after applying anti-seize compound to threads. When shaft bottoms out against rail, back shaft out ½ turn. Install lockwasher and nut, then torque nut to 600 ft./lbs. ±60.

3. Put the spring (hook ends to the rear) and axle assemblies in place and retain with spring rollers, bolts, and nuts. Note: Front hanger requires a lockwasher under the bolt head and no nut. Rear hangers use bolt, lockwasher, nut, spring roller, and rubber bushing. Equalizers require bolt, spring roller, lockwasher, and nut.

4. Set each adjustable torque arm to the same length as the rigid torque arm. Using T-2243 bolts, T-2224 washers, T-2242 bushings, and T-1722 lock nuts, install one end of each torque arm in the axle seat torque arm pivot joints with rigid torque arms on the curb side of the vehicle.

   Using T-1843 bolt, T-1724 washers, T-1842 bushings, and T-1722 lock nuts, install the other ends of the torque arm in their respective hanger torque arm joints.

   Install adjustable torque arm tube clamp bolts, washer, and nuts, but do not tighten until the axles are aligned.

5. Align suspension and tighten torque arm bushing bolts to 200 ft./lbs. ± 15 of torque and torque arm tube clamp nuts to 80 ft./lbs. ± 8 torque. After axle alignment, tighten U-bolts to 300 ft./lbs. ± 25 of torque.

REYCO MODEL 102W INSTALLATION

1. Locate and mount front center and rear spring hangers, and tighten all mounting bolts to 165-195 ft./lbs. (5/8" Grade 8.2 Fasteners).

2. With all hangers installed, insert equalizer casting (Note: "This side in") so that slot in rubber bearing sleeve engages the two lugs cast on the inside surface of the center hanger. Install threaded equalizer shaft by hand after applying anti-seize compound to threads. When shaft bottoms out against rail, back shaft out ½ turn. Install lockwasher and nut, then torque nut to 600 ft./lbs. ±60.

REYCO MODEL 102W INSTALLATION (CONT.)

3. Put the spring (hood ends to the rear) and axle assemblies in place and retain with spring rollers, bolts, and nuts. NOTE: Front hanger requires a lockwasher under the bolt head and no nut. Rear hangers use bolt, lockwasher, nut, spring roller, and rubber bushing. Equalizers require bolt, spring roller, lockwasher, and nut.

4. Set each adjustable torque arm to the same length as the rigid torque arm. Using 10033-01 (7/8" x 5½") bolts and 10092-01 lock nuts, install one end of each torque arm in the axle seat torque arm pivot joints with rigit torque arms on the curb side of the vehicle. NOTE: On vehicles with 50" axle spacing, mount the (2) shorter torque arms on the forward axle. (1) Rigid torque arm (11184-01) and (1) adjustable torque arm (11188-01) or cast end torque arm (15356-01). Using T-1843 bolt, T-1724 washers, T-1842 bushings, and 14169-01 lock nuts, install the other ends of the torque arms in their respective hanger torque arm joints. A

   Install adjustable torque arm tube clamp bolts and nuts, but do not tighten until the axles are aligned. A

5. When both ends of torque arms are installed in their respective joints, tighten nuts at axle seat torque arm joint to 250 ft./lbs. ± 20. Torque and tighten hanger torque arm joints to 200 ft./lbs. ± 15 torque.

6. Align suspension and tighten cast torque arm tube clamp nuts to 150 ft./lbs. ± 15 torque. After suspension alignment, tighten U-bolts to 300 ft./lbs. ± 25 torque. A

7. Torque Arm Fastener Torque Valves, Ft./Lbs.

MODEL	HANGER END	AXLE SEAT END
101A	160 ± 10	250 ± 20
102	200 ± 15	200 ± 15
102W	200 ± 15	250 ± 20

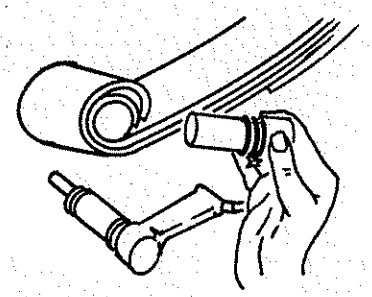
COMPILED	F. F	SHOP PRACTICE KAISER BUSHING AND PIN INSTALLATION	SECTION NUMBER 33-16106
APPRV	V. DORSEY		
ISSUE DATE	01/27/82		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0016-004 FOR KAISER BUSHING AND PIN INSTALLATION PROCEDURE.

Compiled	F.FREER	SHOP PRACTICE	33-16106
Approved	V.DORSEY	KAISER BUSHING & PIN INSTALLATION	
Issued	1-27-82		
Revised		Chg Ltr **FREIGHTLINER CORPORATION** PORTLAND, OREGON	PAGE 1

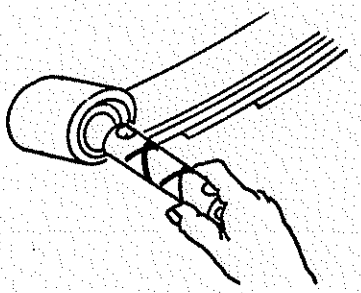
1. Drive out old bushings with an air impact hammer or hand drive adapter.

   Inspect and clean eye bore. REMOVE ALL GRIT, DIRT, AND BURRS.



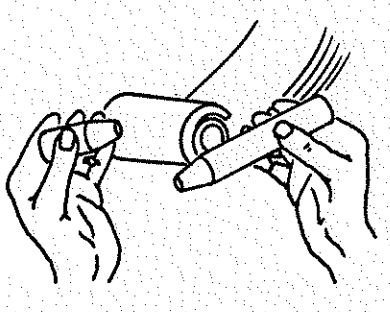
2. Wipe a small amount of grease into the spring eye. Start the bushing assembly by hand with the lead end (smaller diameter) into the eye. Drive the bushing assembly into spring eye until centered in the bore lengthwise using an air impact hammer and drive arbor or hand drive arbor.

3. Wipe small amount of grease on the encased seals each end of the bushing assembly. TEST SPRING PIN IN BUSHING ASSEMBLY BY HAND FOR ALIGNMENT AND FIT. DO NOT FORCE. Spring Pin must have a push through fit. Out of round, grit, and dirt in the eye bore will distort the bushing assembly enough to cause the Spring Pin to bind. To correct this condition, drive the bushing assembly out the same direction it was driven in. Remove obstruction with 80 grit emery cloth, rotary file, or similar tool. Wipe clean and reassemble. NOTE: Bushing assembly can be driven in or out any number of times without damaging it.

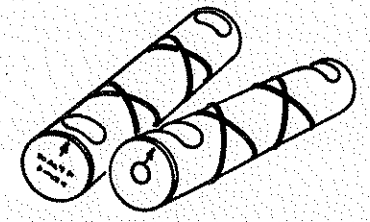


   TEST PIN FOR PUSH THROUGH FIT

4. Raise Spring up to hanger. For alignment, FIRST drive the short line-up pin through into the spring eye (from the inside) until flush with hanger bracket. Then drive in the long line-up pin from the opposite side. Place the spring pin behind the long line-up pin so that the grease fitting hole can be seen. (See drawing) Drive both pins into the spring eye until spring pin is in position. NOTE: To get the proper sealing and grease flow, the grease fitting must face out from vehicle.



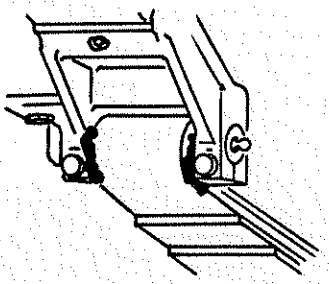
5. Pins are marked with an arrow pointing to the locking flat. Line up pin with hanger bolt pattern and tap into position for locking bolts. Complete Assembly.



GREASING

6. GREASING AFTER ASSEMBLY

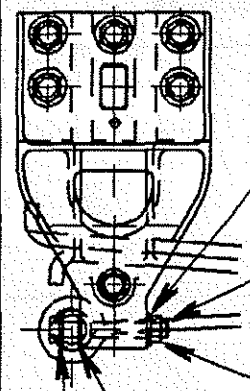
Apply grease until it appears at the opposite end of the spring pin. NOTE: A flow through grease path. A little grease may appear at the fitting end until pressure on the seal is built up. The grooving on the pin and bushing keeps the unit lubricated. Spring units take grease without jacking up the front end and can be greased with NO ADDITIONAL WORK.



CAUTION: Should grease appear at the fitting end in large amounts and little or none at the opposite end - recheck the installation by removing pin and checking the position of the seal retaining ring both ends. A gap in the seal retaining ring of the bushing assembly should be at the opposite end from the grease fitting on the spring pin. Grease is allowed to pass through the seal at this gap.

Compiled	VHD/GHA	SHOP PRACTICE	33-16108
Approved	D.C.R.	SUSPENSION INSTALLATION	
Issued	03-21-86	FREIGHTLINER AIR	PG 1 OF 5
Revised	01-20-89	Chg Ltr G **FREIGHTLINER CORPORATION** PORTLAND, OREGON	PH0307-13

IRON BRACKET



BEARING WASHER 23-09114-000 (1)

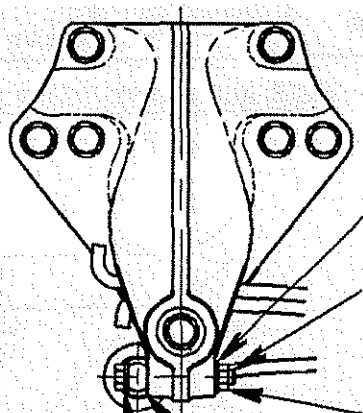
5/8 CAPSCREW 23-09444-500

HEX NUT 23-09901-110 (2)

ALIGNMENT WASHER 23-11856-042 (1)

BEARING WASHER 23-09114-000

ALUMINUM BRACKET



BEARING WASHER 23-09114-000 (1)

5/8 CAPSCREW 23-09444-500

HEX NUT 23-09901-110 (2)

ALIGNMENT WASHER 23-11856-042 (1)

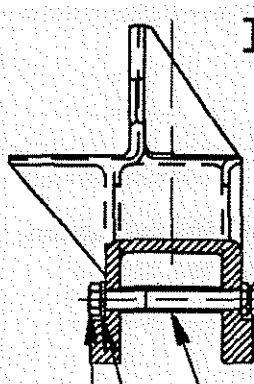
BEARING WASHER 23-09114-000

(1) AXLE ALIGNMENT IS PROVIDED BY INSTALLING SHIMS (23-09144 BEARING WASHER AND/OR 23-11856-042 FLAT WASHER) BETWEEN THE SPRING AND CAST HANGER.

(2) TORQUE THE 5/8" NUT TO 130-160 LB-FT.

(3) INSTALL THE UPPER SPRING RETAINER BOLT AND NEOPRENE SLEEVE. INSTALL THE .750 DIA BOLT FROM THE INBOARD SIDE OF THE FRAME BRACKET. TIGHTEN THE NUT TO 25-30 LB-FT. NOTE: A THIN WALL SOCKET MAY BE REQUIRED DUE TO LIMITED CLEARANCE.

IRON BRACKET



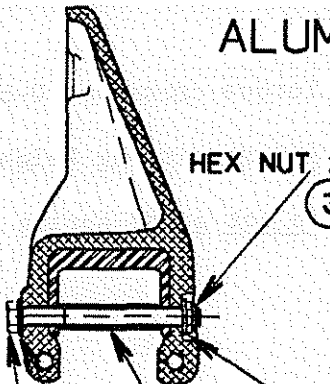
HEX NUT 23-09119-008 (3)

NEOPRENE SLEEVE 16-10776-002

WASHER 23-09114-004

(3) HEX BOLT 23-09447-650

ALUM BRACKET



HEX NUT 23-09119-008 (3)

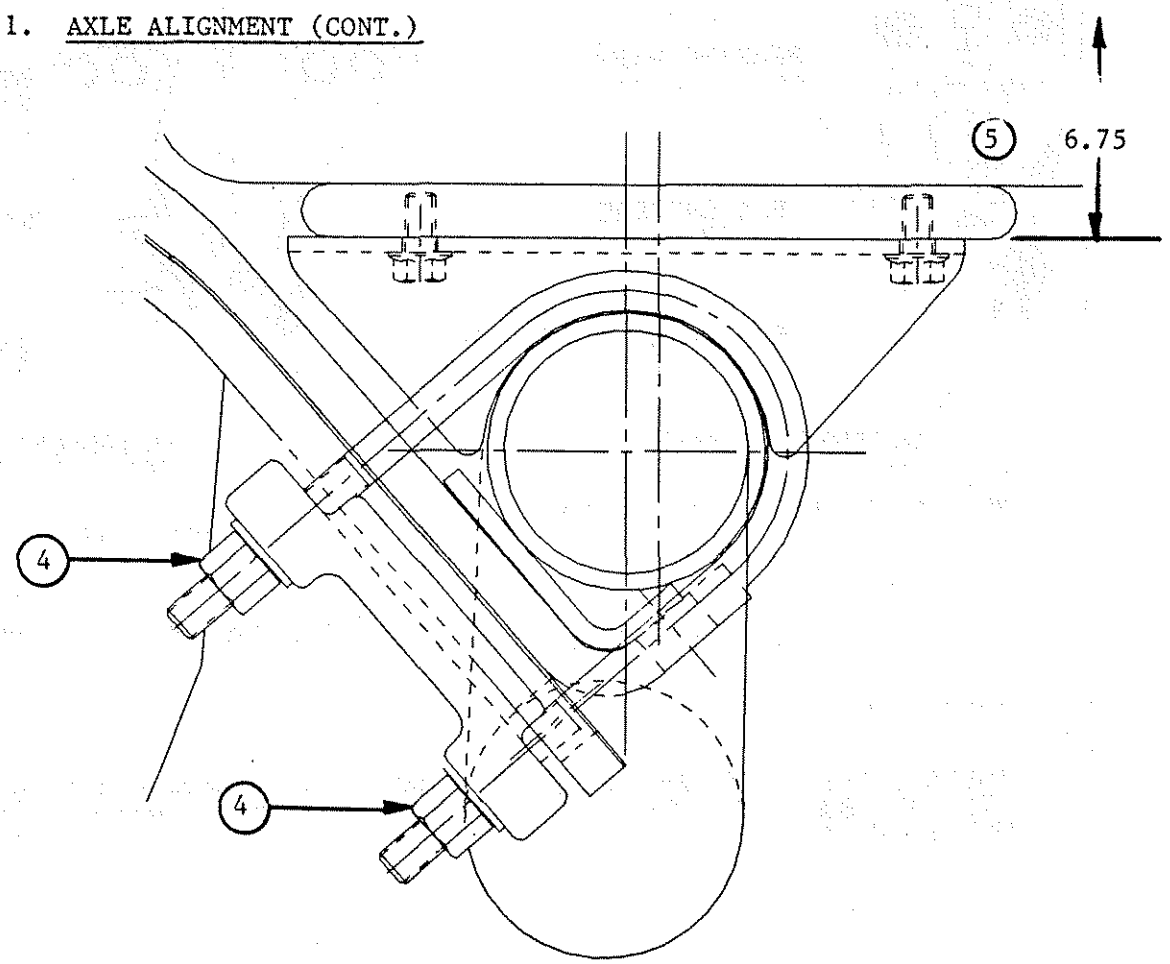
WASHER 23-00600-075

NEOPRENE SLEEVE 16-10776-002

WASHER 23-00600-075

(3) HEX BOLT 23-09447-750

1. AXLE ALIGNMENT (CONT.)



4. Torque crosstube U-bolts to 70-85 Ft/Lbs.

5. Adjust air bag height to dimension shown.

6. Do not grind spring or spring seat for fitting at installation.

2. VALVE PLUMBING:

Delco and Neway Valves are used interchangeably on the Freightliner air suspension (not on Neway). The valves function identically but the Delco valve requires a special fitting. Ref: A23-11342-001.

3. HEIGHT CONTROL VALVE ADJUSTMENT:

Adjustment of the height control valve should be performed with the vehicle on a level surface. Adjust the height control valve as follows:

1. Park the vehicle on a level surface, then chock the tires. Run the engine to build up and maintain a vehicle air pressure of at least 70 psi (482 kPa) throughout the system.

2. Disconnect the height control valve linkage from the overtravel lever.

3. Exhaust the air from all air springs by moving the overtravel lever to the vertical down position.

4. Loosen the adjustment locknut, and move the overtravel lever until the stud in the nylon block (overtravel control body) is centered in the overtravel lever adjustment slot. Refer to Fig. 3. Then, tighten the adjustment locknut to 6-8 ft-lbs.

   NOTE: (Neway height control valves ONLY) To aid in centering the nylon block stud in the overtravel lever adjustment slot, temporarily insert a 3/16 inch diameter locating pin (or a 3/16 inch drill bit) in the hole in the mounting bracket, as indicated in Fig. 3. After tightening the adjustment locknut, remove the locating pin (drill bit).

5. Connect the overtravel lever to its linkage, and allow the air spring(s) to fill until the valve shuts off.

6. Measure the distance from the bottom of the frame rail to the bottom of the air spring(s). This measurement should be performed on the forward drive axle for tandem drive installation. This dimension should be 6 3/4" ± 1/8" (172mm). Adjust the height control valve by loosening the valve mounting bolts and rotating the entire valve slightly until the height dimension is attained.

   IMPORTANT: Because of a built-in time delay in the height control valve, two to six seconds will be required after making adjustments before a change will occur in the height dimension.

7. Tighten the valve mounting capscrew nuts to 9-11 ft-lbs. (15 N'm).

8. Disconnect the height control valve linkage and allow the air spring(s) to deflate approximately halfway. Then, connect the linkage to inflate the air spring(s), and check the height dimension again. Repeat steps

3. HEIGHT CONTROL VALVE ADJUSTMENT (CONTINUED)

8. (Continued)

6 through 8 until the heigh dimension measures 6 3/4 inches (172mm).

See Fig. 1

NOTE: If the height dimension is not within 1/8 inch (3.2mm) of the required 6 3/4"± 1/8" (172mm), the final adjustment can be made by loosening the adjustment locknut and moving the overtravel lever slightly, relative to the nylon block overtravel control body). Then, tighten the adjustment locknut to 6-8 ft-lb. The final setting should be checked on the up stroke of the suspension (i.e. pressurizing the bags.)

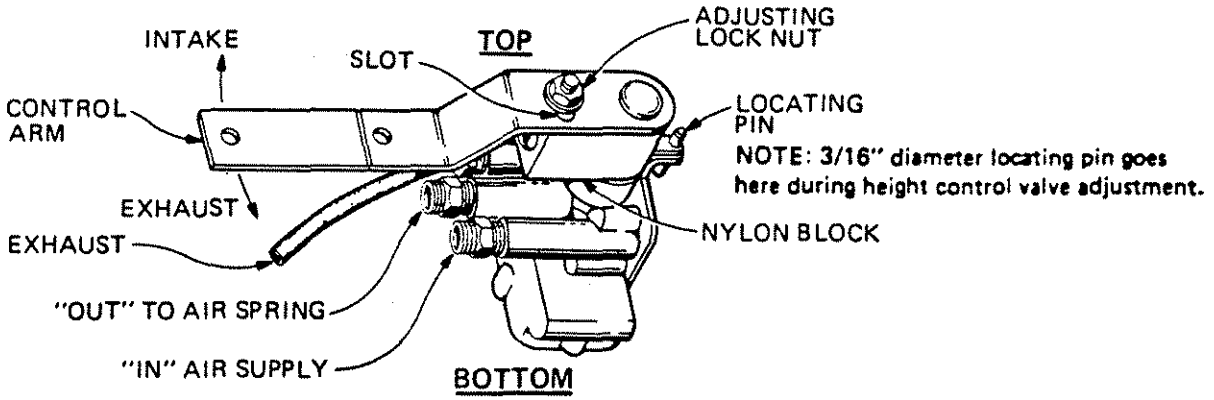
9. When the height control valve is adjusted, disconnect the overtravel lever from the height control valve linkage, and rotate it to the vertical down position to fully deflate the air spring (s).

10. Connect the linkage assemblies to the overtravel levers.

11. Remove the chocks from the tires.

CAUTION: Failure to adjust the height control valve as explained above could adversely affect driveline angles. In addition, if the air springs are set too high, the driver may have difficulty (or be prevented from) manuevering the vehicle under the trailer.

Fig.3



12. NOTE: Final height adjustment is an "in-service procedure" with a loaded chassis.

4. OPTIONAL ADJUSTMENT METHOD

A. Disconnect the height control valve linkage, push the overtravel lever to the "up" position, and raise the vehicle. Then position jack stand under each frame rail at the proper ride height. With the jack stands in position push the overtravel lever to the "down" position lowering the vehicle, deflating all air from the air, springs. Recheck for proper ride height.

Note: It may be necessary to shim jack stands to achieve proper ride height.

B. Move overtravel lever to 45° "down" position for a duration of 10-15 seconds. Return the overtravel lever slowly to the center position and insert a 3/16 in locating pins in the valve (overtravel control body). Then loosen the adjustment locknut and reconnect the linkage.

C. Retighten the adjustment locknut to 6-8 ft-lbs.

D. Remove the locating pin and raise the vehicle to remove the jack stands. The height control valve may be used as an improvised jack, by disconnecting the linkage and pushing the overtravel arm "up". Once the jack stands are removed push the overtravel lever "down", completely exhausting the air springs, then reconnect the linkage. The suspension should return to the proper ride height.

Compiled	D. Reeves	SHOP PRACTICE	33-16109
Approved	D.C.R	TORQUING OF SCREW FASTENERS	
Issued	5-1-86		
Revised		Chg Ltr **FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 1

SPECIAL VALUES: For the fasteners listed, use the indicated torque values.

FASTENER	THREAD SIZE	GRADE BOLT MAT'L	TORQUE FT-LB	REMARKS
Nut, Beam End Adapter	3/4-16 UNF	-	210-250	(HDR)
Nut, Vert. Drive Pin	1½-12 UNF	-	175-225	(HDR) "Gripco" Locknut
Stud, Vertical Drive Bushing Cap	5/8-11UNC	-	55-65	(HDR)
Nut, Vertical Drive Bushing Cap Stud	5/8-18 UNF	-	100-125	(HDR)
Stud, Saddle Cap	7/8-9UNC	-	55-65	(HDR)Coarse thread into saddle
Nut, Saddle Cap Stud	7/8-14 UNF	-	225-275	(HDR) "Gripco" Locknut

GENERAL VALUES: See 33-00109

SPECIAL TORQUE VALUES: (Continued)

FASTENER	THREAD SIZE	GRADE BOLT MAT'L	TORQUE FT-LB	REMARKS (MFR)
Nut, Torque Rod Stud	1 1/8-12 UNF	-	175-225	(HDR)
	1 1/4-12 UNF	-	175-225	(HDR)
Nut, Adapter Bolt	3/4-16 UNF	-	210-240	(HDR)
Nut, Equalizer Retainer	1 3/4-12 UN	-	(as reqd)	(FL) Adjust for 40-60 lb. at end of equalizer to tilt equalizer.
Nut , Spring Center Bolt	7/16-20 UNF		50-60	(HDR-Mod RT Suspension)
	1/2 -20 UNF		65-75	
Nut, Spring Pin Draw Key	-		75-100	(HDR-Mod RT Suspension)
Nut, Top Pad to Saddle	-	-	275-300	(HDR-Mod RT Suspension)
Nut, Spring Rear Hanger Rebound Bolt	1/2-13 UNC	-	70-80	(HDR-Mod RT Suspension)
Set Screw, Spring Aligning Top Pad to Spring	-	-	100-150	(HDR-Mod RT Suspension)
Nut, Saddle Cap Stud	7/8-14 UNF -2B	-	225-275	(HDR-Mod RT Suspension) Gripco Self Locking Nut
Nut, Torque Rod Stud	1 1/4-12 UNF	-	175-225	(HDR-MOD RT Suspension)
Nut, Adapter Bolt	3/4-16 NF-3	-	210-240	(HDR-Mod RT Suspension) See HDR # BA-11210-8
Stud, Saddle Cap	-	-	55-65	(HDR-Mod RT Suspension)
Nut, Top Pad Set Screw	-	-	Tighten	until lock washer is flat. (HDR-Mod RT Suspension)

FASTENERS: Freightliner spring and Freightliner air suspensions will use as standard: Grade 8 capscrews (phophate and oiled), Grade 8 prevailing torque nuts (cadmium and waxed) with hardened washers under both capscrew and nut for suspension bracket mounting. See 33-00109 for torque valves.

Part Numbers:

NOM. SIZE	WASHER	CAPSCREW	NUT
1/2	23-09114-003	23-09440-#	23-09901-108
5/8	23-09114-000	23-09444-#	23-09901-110

In addition, on the Freightliner rear spring suspensions, the crossmember closest in proximity to the forward (rear) suspension bracket should also use non-flanged hex fasteners per above.

Compiled	J. Larson	SHOP PRACTICE	
Approved	D. Rinfield	SHACKLE ANGLE, CLEARANCE	33-16110
Issued	1-16-68		PG 1 OF 1
Revised	09/21/89	Chg Ltr E FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2006-88

D

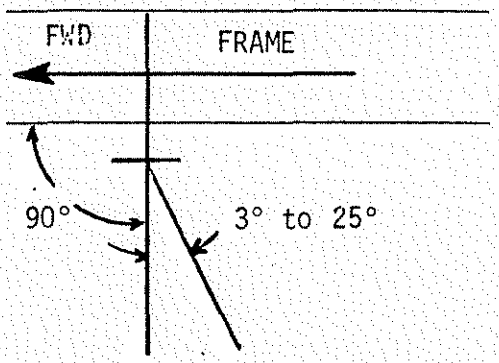
1. ANGLE:

E The shackle angle must be maintained between 3° and 25° aft of vertical with the bottom to the rear.

This is to be measured in the tare condition.

E Spring must be changed if these limits are exceeded.

Shackles to be within 5° of each other.



D

2. CLEARANCE:

The distance from the the fuel tank to the rearmost point of the front spring shackle must not be less than 2.00" at tare.

COMPILED	ANDERSON	SHOP PRACTICE FRONT SUSPENSION INSTALLATION	SECTION NUMBER 33-16201
APPRV	D C R		
ISSUE DATE	03/21/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0016-005 FOR FRONT SUSPENSION INSTALLATION PROCEDURE.

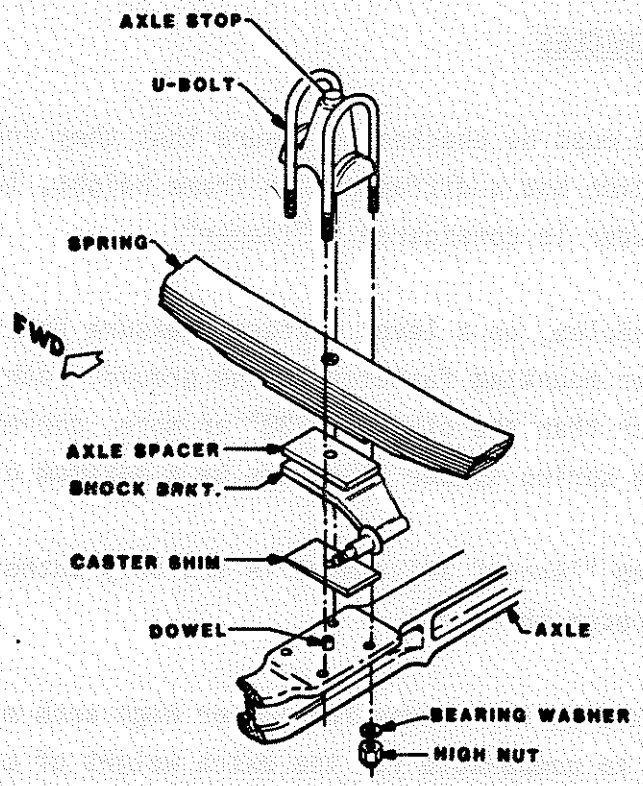
A. FASTENERS

1. Install hardened bearing washers (Ref. 23-9114-005 for 7/8" U-Bolts) under U-Bolt High Nuts.

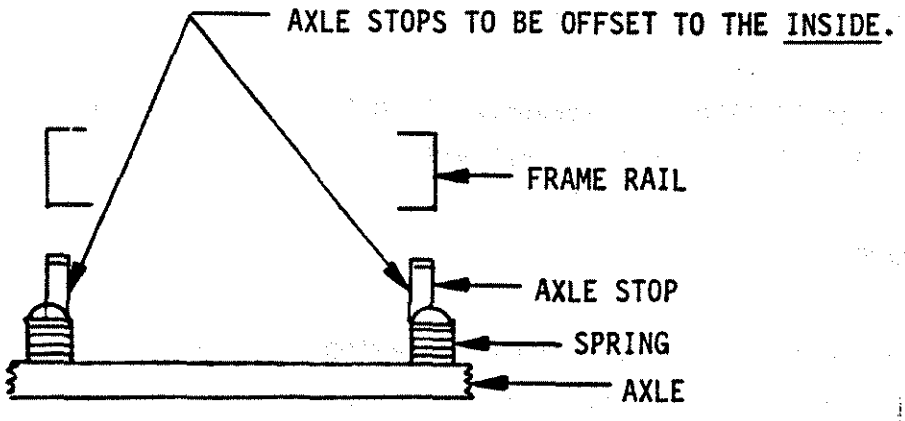
2. See also 33-11105, Paragraph 2, "U-Bolts", for some further considerations on axle installations.

B. AXLE SPACERS

1. Do not change front axle spacer, 16-10386-#, from what is specified to prevent adverse effects on steering linkage geometry. Refer to Page 2 for allowable adjustments on leaner vehicles.



C. AXLE STOP



D. "LEANER" TYPE VEHICLES

1. All vehicles must be checked to insure that they are not "leaners". A vehicle which has a difference in frame height, left to right, of 3/8" or greater is considered a "leaner".

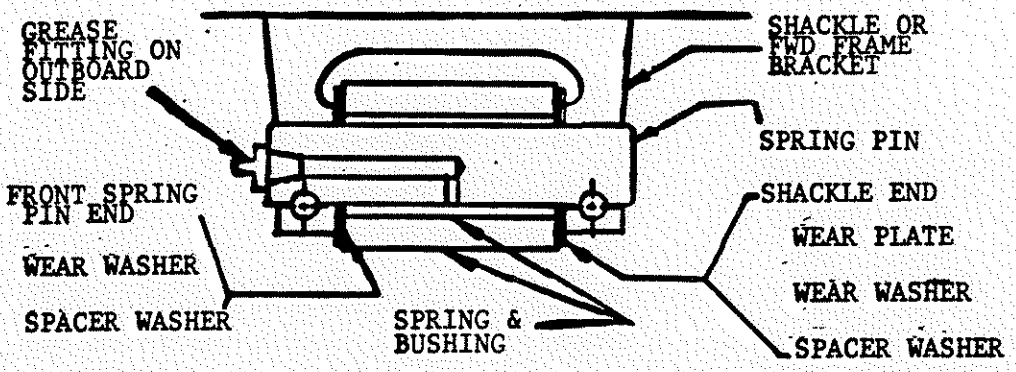
2. To check vehicles, on a level surface, measure from the outboard bottom bumper mounting fastener to the ground, both sides, and if one is higher than the other by .38" or more, correct by increasing the low side spring spacer thickness by a maximum of .50 inches.

3. The foregoing "leaner" adjustment is the only authorized alteration of spring spacer thickness.

4. Springs marked by the vendor for low or high arch may also be used as required to compensate for the extra weight of components on one side of the vehicle.

E. SPRING INSTALLATION IN SHACKLE AND FORWARD FRAME BRACKET

1. Install spacer washers (Ref. 23-09860-012) so there is less than one washer thickness of total clearance using an equal number of washers on each side, if possible. Prior to delivery, recheck clearance.

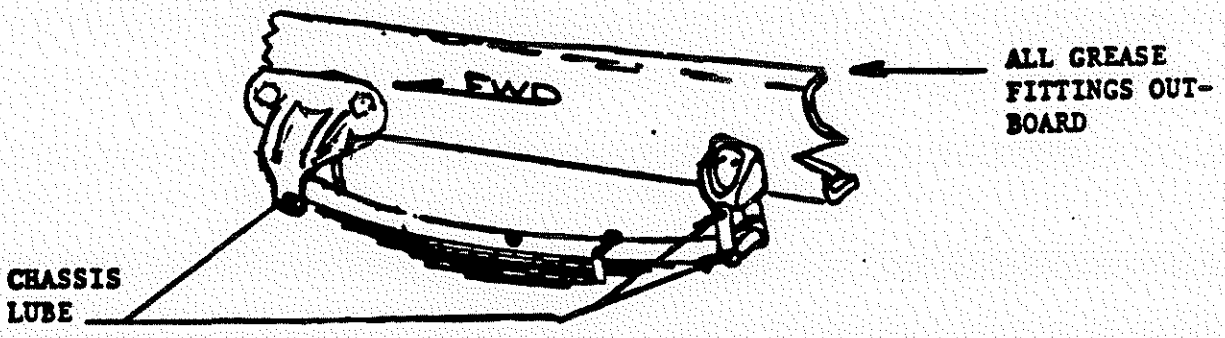


F. ASSEMBLY LUBRICATION OF FRONT SUSPENSION SPRINGS AND SHACKLE ASSEMBLIES

1. Clean inside diameter of all front suspension bushings (spring eyes and shackle bracket) prior to assembly. Prelube both the pins and bushings prior to assembly with grease, 48-25015-001.

   Caution: Do not use alumilastic on spring pins or bushings.

2. Final assembly line chassis lube may use lubricants in accordance with 33-00102.



Compiled	F.FREER	SHOP PRACTICE HOOD, CONTENTS	33-17100
Approved			
Issued	04/07/65		
Revised	06/06/89	Chg Ltr N FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2006-53

PRACTICE NO.	DESCRIPTION

This Group Has No Content.

COMPILED	F.FREER
APPRV	DRS
ISSUE DATE	06/16/69
REV DATE	04/15/94
CHG LTR	AD

SHOP PRACTICE

CONTENTS,
CAB

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-18100

PAGE
1 OF 1

PA2042-45

	PRACTICE NO.	DESCRIPTION
	33-18102	CAB ASSEMBLY
	33-18103	CAB UNDERCOATING
	33-18104	CAB PIVOT INSTALLATION
	33-18105	CAB LATCH INSTALLATION
	33-18108	FASTENERS, CAB
	33-18109	TORQUING OF SCREW FASTENERS
	33-18111	CAB SEALING
	33-18112	CAB INSULATION
	33-18115	WINDSHIELD & WINDOW INSTALLATION
AD		
	33-18117	AIR LINE PROTECTION
	33-18118	LABEL INSTALLATION (INCLUDING FMVSS)
	33-18120	CAB TILT INSTALLATION
	33-18122	HEAD LINER INSERT INSTALLATION
	33-18123	CAB MASK INSTALLATION, COE
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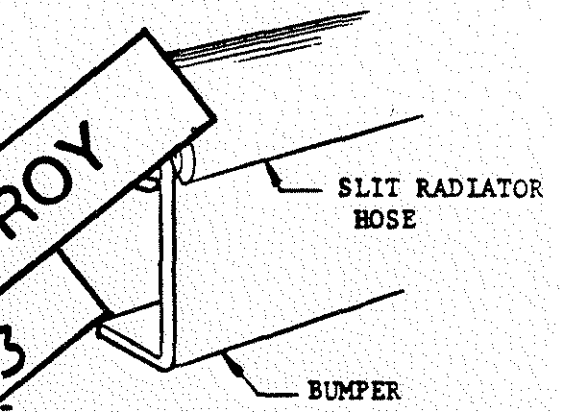
	33-18130	CAB DOOR INSULATION
	33-18131	INTERIOR SUNVISOR
	33-18303	STRIKER TEST, DOOR, BAGGAGE

Compiled	H.J.R.	SHOP PRACTICE CAB INSTALLATION	33-18101
Approved	C.D.		
Issued	2-28-66		
Revised	4-5-74	Chng Ltr: A FREIGHTLINER CORPORATION PORTLAND, OREGON	

PROTECTION OF CAB WHILE MOUNTING

Since the Cab is mounted on the vehicle in essentially finished condition, it is important to protect paint and brightwork from scratches and scuffing. The following are some areas that need protecting and some suggestions for doing this simply and effectively:

A. FRONT SKIRT- A two foot length of 2" radiator hose, slit full length, can be slipped over the top flange at each outboard end of the bumper while the cab is being manoeuvered into place. Besides cushioning any bumps, this has the added advantage that a small amount of slippage or rolling of the slit hose can reduce scuffing of the parts.



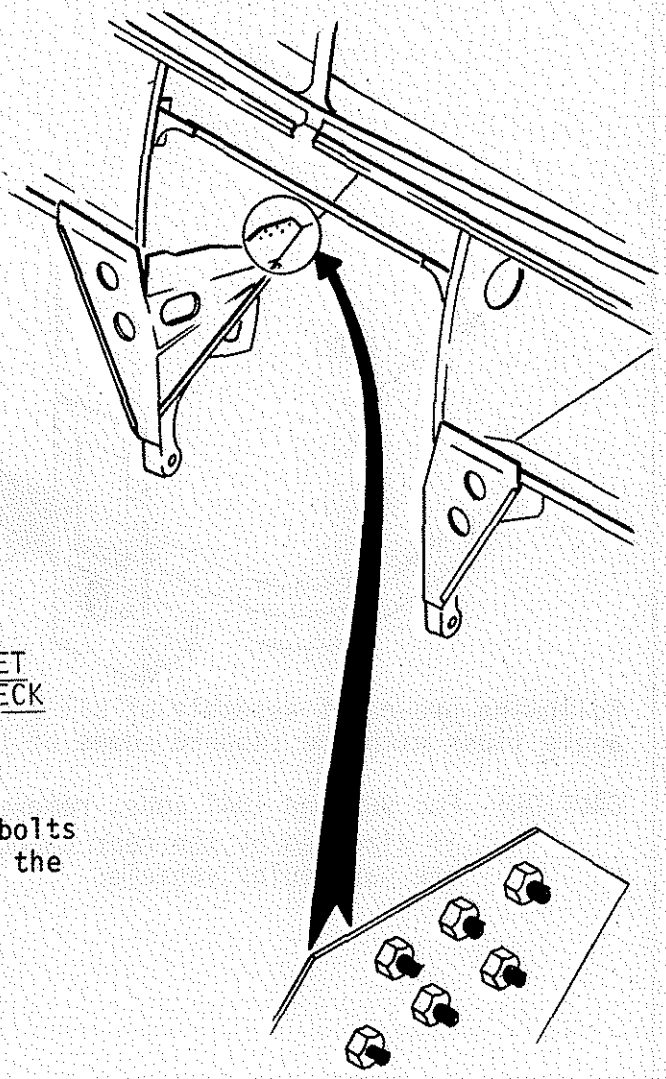
B. LIFT POINTS- A "T"- frame wi… cushioned hooks is used for the cab to mounting posi… pass under the top pe… grab handles on eac… and a third hook … radiator openi… line. Make … don't scu… become straigh… ake care that the control box for the hoist isn'… inish during these operations.

C. L… RS IN C… - Make sure all loose objects, especially the la… es, are adequately secured, or placed well forward on the floo… before tilting the cab.

D. Shift stick should be pulled to a rearward position when lowering the cab onto the chassis, because the stick in a forward position could damage lower righthand dash console.

REMOVE & DESTROY 8-16-83

A

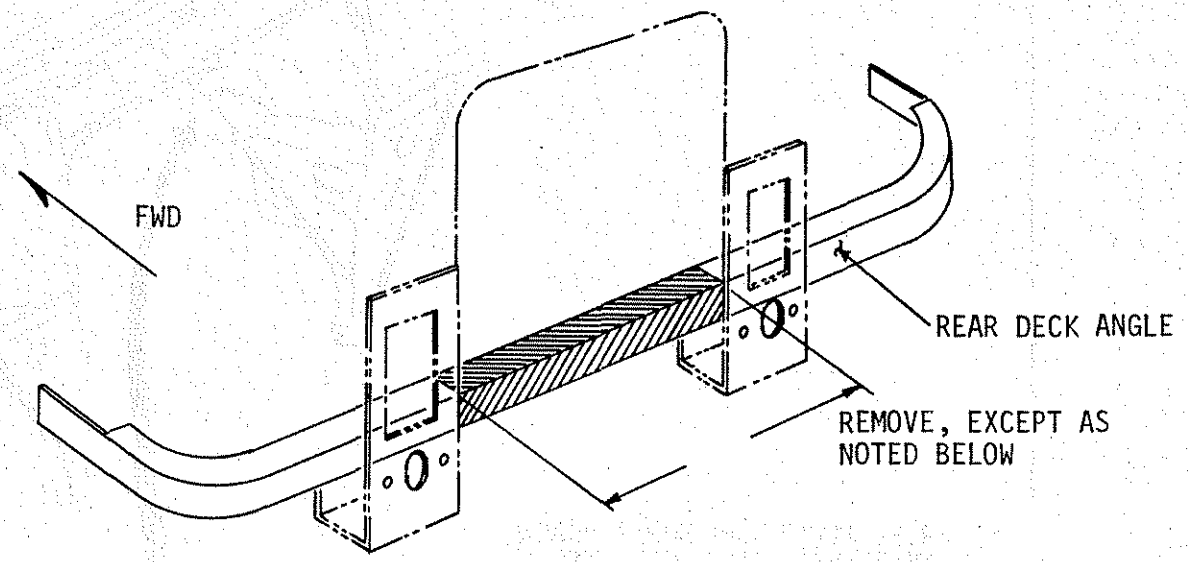


1. R.H. FRONT CAB MOUNT BRACKET ATTACHMENT TO TUNNEL AND DECK

   A. All Cabs

      Install with heads of bolts in the cab and nuts in the tunnel.

REMOVAL OF REAR DECK ANGLE



Following pre-paint assembly of all except 96" and 104" cabs, cut the rear deck angle flush with the inboard edges of the rear cab mounts, remove and discard it.

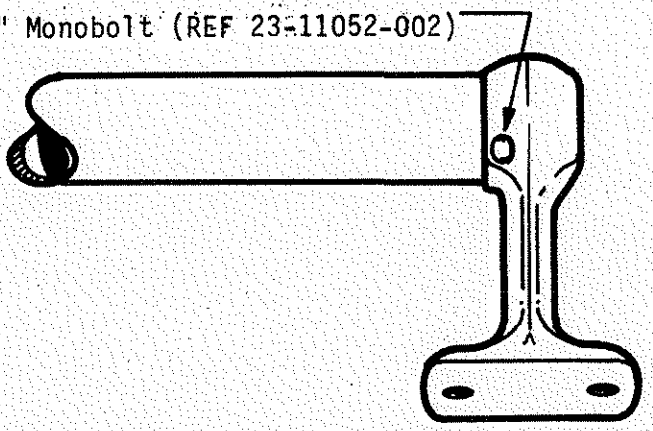
CAUTION: For 96" and 104" cabs, remove and discard angle in same manner only if directed by the rear channel installation diagram called out on the particular vehicle.

A

REVISED & RETYPED D CHANGE

PREVENTION OF HANDLE ROTATION

Rivet tube and grab handle bracket together using a monobolt shown below.



NOTE: Insure that the pin breaks off flush with the bolt head.

COMPILED	BLAKEWOOD	SHOP PRACTICE UNDERCOAT	SECTION NUMBER 33-18103
APPRV	D R S		
ISSUE DATE	04/04/80		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	H		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-001 FOR UNDERCOATING PROCEDURE.

Compiled	BLAKEWOOD	SHOP PRACTICE	33-18103
Approved	DRS	UNDERCOAT	
Issued	04/04/80		PG 1 OF 2
Revised	09/21/89	Chg Ltr F FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2006-88

PURPOSE: Undercoating has chiefly two purposes:

1. To protect the metal from surface damage.
2. To reduce the production and transmission of noise, especially in the higher frequency range.

PREPARATION: The surface to be coated should be clean, but does not need to be elaborately sanded and etched as for priming for paint. The asphalt-clay-water emulsion will adhere well to smooth surfaces if kept free of dirt, oil, grease, and wax. Surfaces to be coated need not be dry, since the product is a water emulsion.

APPLICATION: Undercoat (Ref. 48- 2206) is applied by direct pressure, which carries the coating into corners better than the entrained air type.

A fan type nozzle is swept forth and back across the work until the desired 1/16 inch thickness is built up. Do not apply too heavy a coat or it will tend to separate and fall off.

A complete, full thickness coat is to be sprayed onto the following COE and Conventional cab surfaces:
Do not use inside cab.

1. Underside of both LH and RH decks, including splash guards or covers for hoses, and inside of cab skirt. (See Restrictions)
2. Engine side of the tunnel. (See Restrictions)
3. Back side of lower nose skin, except oil fill cover hinge. (COE Only)
4. Back side of center nose skin.
5. Firewall area. (Conventional) (See Restrictions)

F

DRYING: Undercoat is water resistant only after it has been allowed to dry sufficiently. Drying time will vary depending upon the temperature, humidity and motion of the air. With warm dry air in gentle motion, drying will take about half a day. Cooler, moister, stagnant air will lengthen drying time and increase the danger of "peeling" if put into service too soon.

OVER PAINTING: A heat reflective coat of aluminum paint is optional in the engine tunnel. This can be sprayed on soon after the undercoat is applied. (Drying time for the undercoat will be increased somewhat if this is done, but good coverage can be obtained.)

RESTRICTIONS: Vehicles receiving a foam tunnelliner are not to be undercoated in the area covered.

Cabs receiving E-COAT are to be undercoated after the E-COAT application.

Maintain a clear area for a 2" radius around the centerline of the brake valve on the underside of the COE LH deck.

COMPILED	H J R	SHOP PRACTICE CAB PIVOT INSTALLATION	SECTION NUMBER 33-18104
APPRV	E TRAUB		
ISSUE DATE	09/23/68		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-002 FOR CAB PIVOT INSTALLATION PROCEDURE.

Compiled	H.J.R.	SHOP PRACTICE CAB PIVOT INSTALLATION	33-18104
Approved	E.TRAUB		
Issued	9-23-68		
Revised	1-30-84	Chg Ltr D **FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 1

A. GENERAL

1. The pivot bolt (pin) is assembled with the head in the outboard direction and the nut on the inside. A 5/8-11 UNC Grade 8 flange nut is used to secure the bolt.

2. The illustration below shows the replaceable parts used in the cab tilt pivot. In the illustration, #2 is the cast urethane bushing that is pressed into the cab tilt pivot bracket.

B. BUSHING INSTALLATION

When installing the bushing, push or hammer it carefully into the machined hole in the casting until an equal amount of the bushing extends out each side. In this process be careful not to mar the surface of the urethane bushing.

C. CAB MOUNTING

Bring cab pivot hole into alignment with the frame pivot hole. The cab tilt pivot bolt (1) can then be installed, with its head outboard. With the bolt fully inserted, install the nut (4).

(Continued)

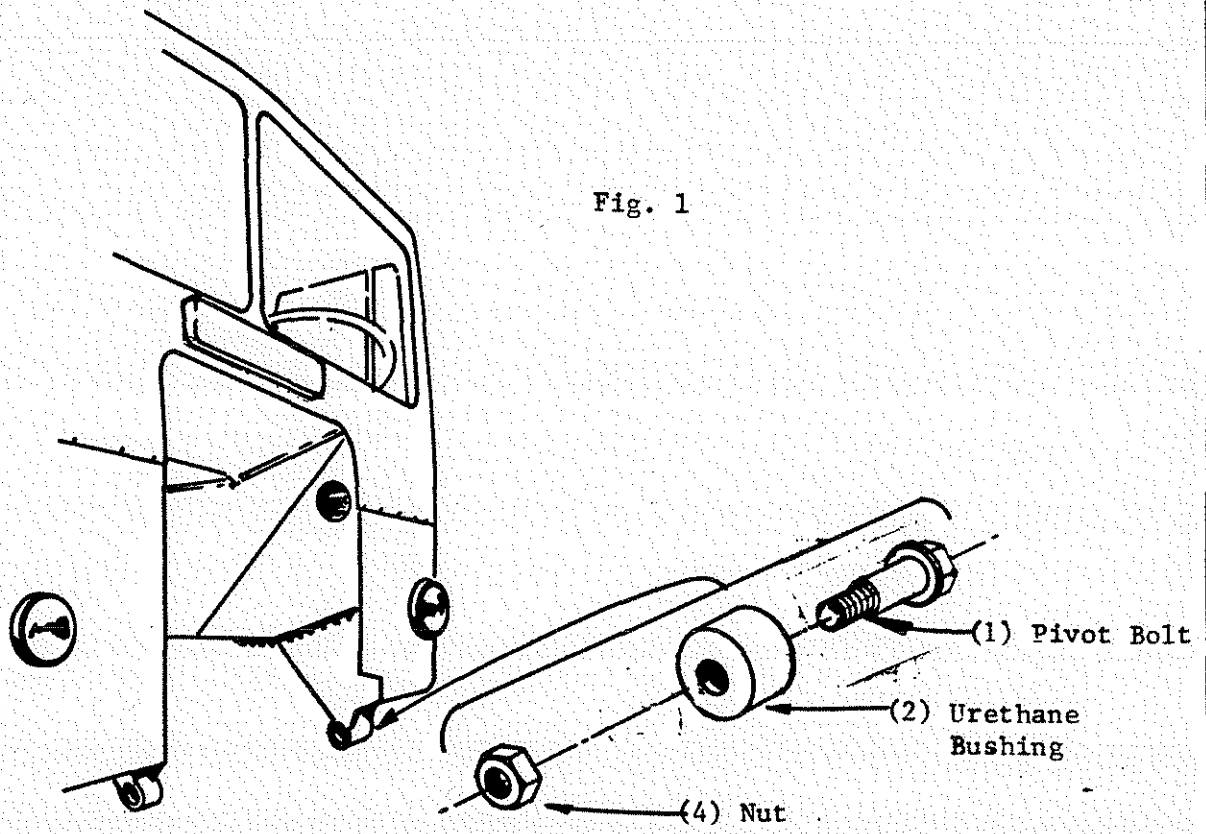


Fig. 1

D REVISED & RETYPED "B" CHG

Compiled	H.J.R.	SHOP PRACTICE CAB PIVOT INSTALLATION	33-18104
Approved	E.TRAUB		
Issued	9-23-68		
Revised	10-30-81	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

A. GENERAL

1. The pivot bolt (pin) is assembled with the head in the outboard direction and the nut on the inside surface of the frame rail. A 3/4-16 UNF Grade 5 locking nut is used to secure the bolt.

2. The illustration below shows the replaceable parts used in the cab tilt pivot. In the illustration, #2 is the cast urethane bushing that is pressed into the cab tilt pivot bracket.

B. BUSHING INSTALLATION

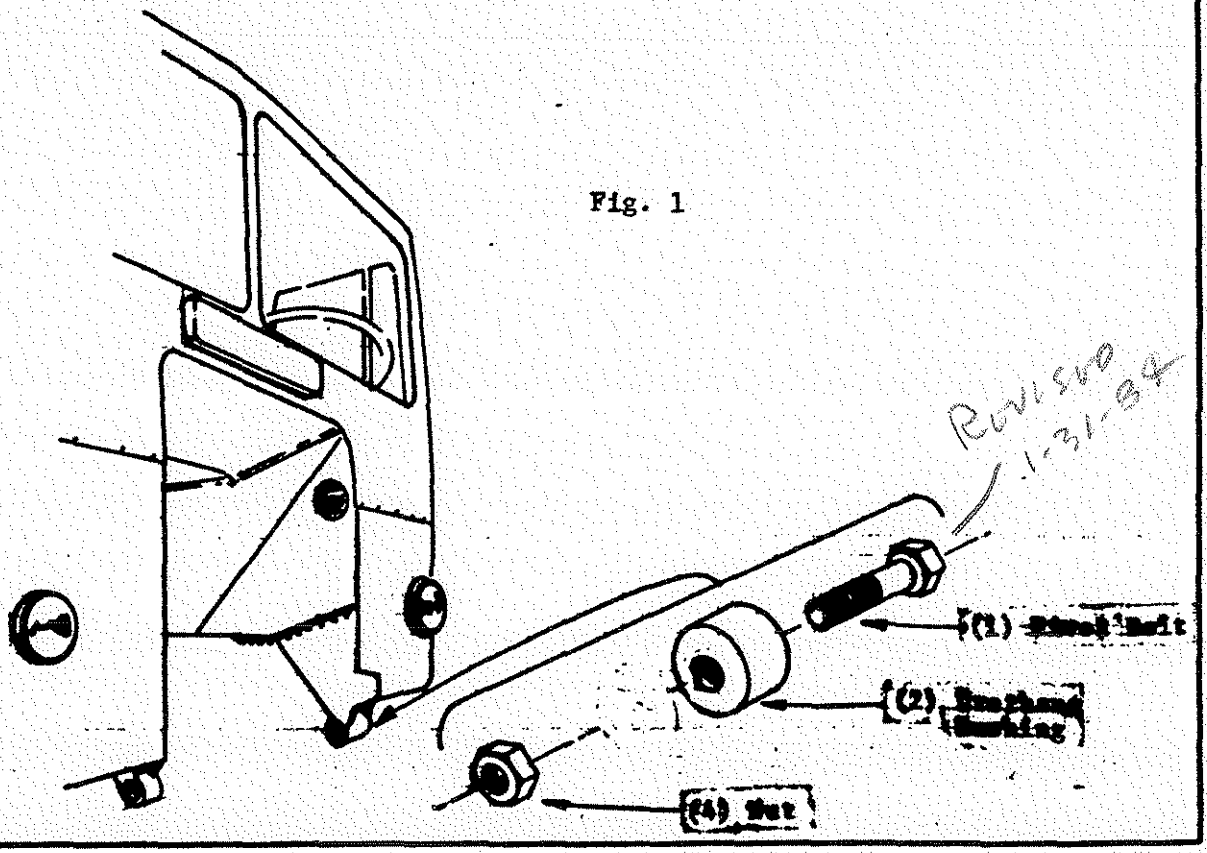
When installing the bushing, push or hammer it carefully into the machined hole in the casting until an equal amount of the bushing extends out each side. In this process be careful not to mar the surface of the urethane bushing.

C. CAB MOUNTING

Bring cab pivot hole into alignment with the frame pivot hole. The cab tilt pivot bolt (1) can then be installed, with its head outboard. With the bolt fully inserted, and install the nut (4).

(Continued)

Fig. 1



REVISED & RETYPED "B" CHG

C. CAB MOUNTING (Continued)

B 1. It is important that the nut be tightened to 75 - 125 lb. ft.; DO NOT OVERTIGHTEN.

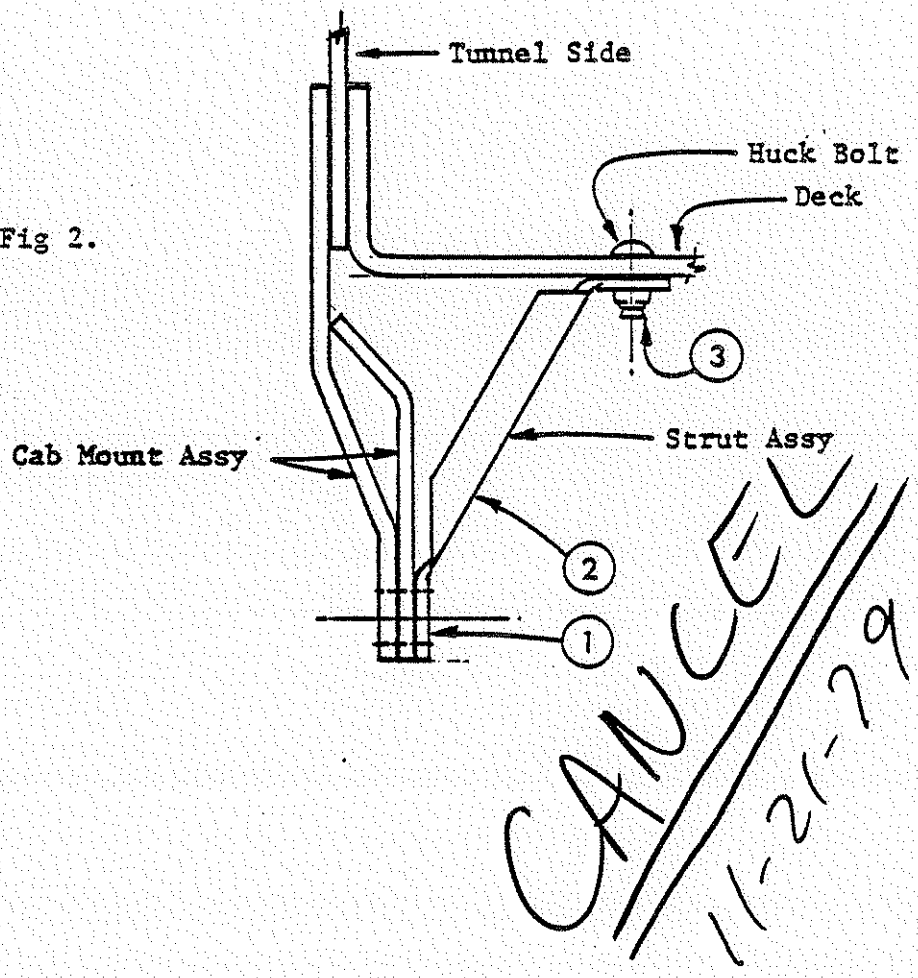
B A 2. With the pivot bolt installed and the nut tightened, there may be a maximum of .030 gap beneath the bolt head.

A 3. Caution: Be sure the correct pin is used. Pin (Fig. 1 (1)) should be Part No. 18-21267. Do not replace the pin with an ordinary bolt.

D. POWERLINER STRUT INSTALLATION (After front mount installation)

1. Insert strut bushing into tilt cylinder mounting hole of the front cab mount assembly.
2. Swing strut into deck and hold firmly in place.
3. Transfer drill through deck and attach with huck bolts.

Fig 2.



CANCEL 11-21-79

COMPILED	T C	SHOP PRACTICE CAB LATCH	SECTION NUMBER 33-18105
APPRV	T C		
ISSUE DATE	10/23/65		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	H		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-003 FOR CAB LATCH PROCEDURE.

Compiled	T. Campbell	SHOP PRACTICE CAR LATCH	33-18105
Approved	Tom Campbell		
Issued	10-23-65		
Revised	6-16-83	Chg Ltr G FREIGHTLINER CORPORATION PORTLAND, OREGON	page 1

A. FUNCTION OF LATCH

The cab latch consists of two separable fastening devices that allow a controlled amount of movement before they stop upward motion of the back of the cab. The looseness is to relieve possible large stresses in the cab due to normal motions of the vehicle frame. The ultimate restraint is to prevent unwanted separation of the air intake duct (in separating systems) while the vehicle is in operation.

B. MOUNT ADJUSTMENT

In order to assure that both mounts contact the mount seats and to correct any minor variations in squareness between the cab and the frame shims (11-9531 and/or 18-9710) may be fitted between the rubber cab mount pad and the latch housing to which it attaches. Both rubber cab mount pads should contact their seats before latches are engaged.

C. LATCH ADJUSTMENT

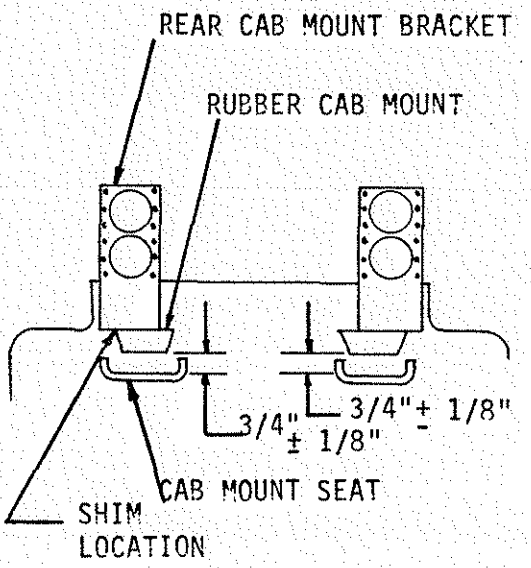
Each U-Bolt must allow just 3/4 inch clearance between cab rear mount cushion block and its seat before stopping the upward motion of the cab. This clearance is set as follows:

1. Lock cab in down position.

2. With cab locks in locked position, carefully raise cab until cab lock U-Bolt springs are completely compressed.

3. Measure distance between the rubber cab mount and its seat. (See sketch)

   This measurement should be 3/4". Tighten nuts against cab lock U-Bolt springs if this measurement is more than 3/4". If the measurement is less than 3/4", release tension on the springs.



D. HANDLE POSITION

The handles of the COE cab hold-down latches are both to be assembled in the "DOWN" position.

If structural interference prevents mounting either one or both handles in this preferred position, both handles are to be assembled in the "UP" position.

E. PAINTING

Prime and paint the cab catch hook the same color as the cab exterior.

Compiled	N.J.R.	SHOP PRACTICE CAB VENTS	33-18106
Approved	L.J. Smith		
Issued	7/27/66		
Revised	1-12-68	Chng Ltr:	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

Unless otherwise specified, the cab vents are to be mounted as follows:

All vents to open to the front, except that the left vent to the sleeper compartment shall open to the rear.

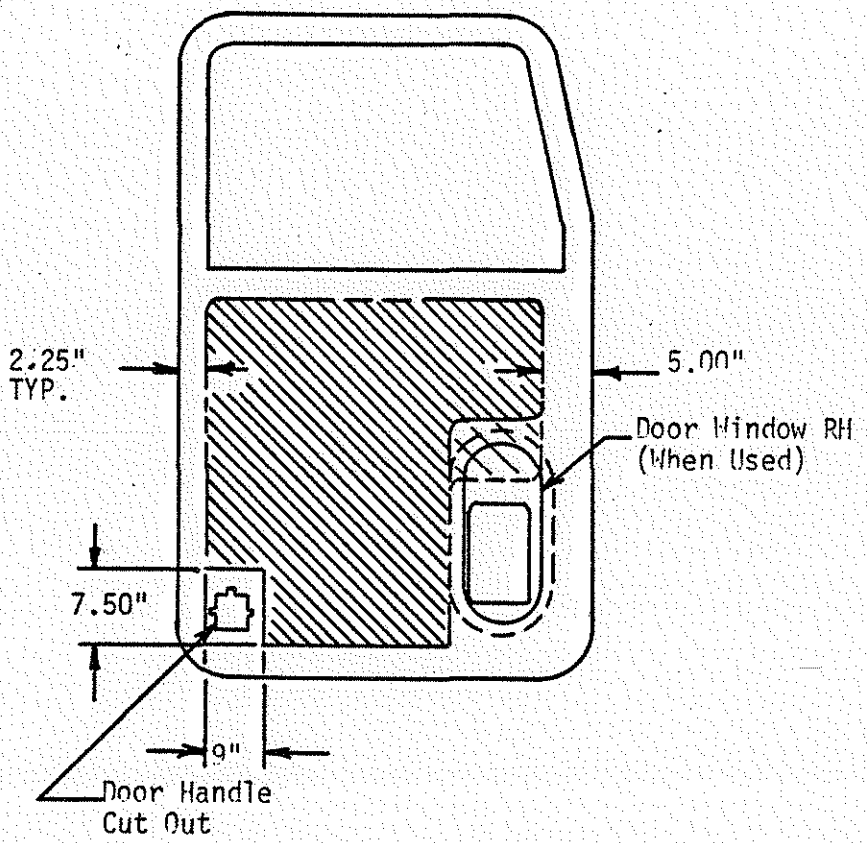
REMOVE & DESTROY

Compiled	FRANKLIN	SHOP PRACTICE CAB DOOR ASSEMBLY	33-18107
Approved	B KOEPKE		
Issued	12/16/68		
Revised	6-23-80	Chg Ltr H FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

A. UNDERCOATING of the door shall be applied following the procedures described in Shop Practice Manual 33-00116 using undercoating material per 48-02206.

The area to be covered on each door is shown in the sketch below:

H



B. DOOR WINDOW If properly installed the door window should require no more than 15 pounds effort at the crank end to elevate or lower the window.

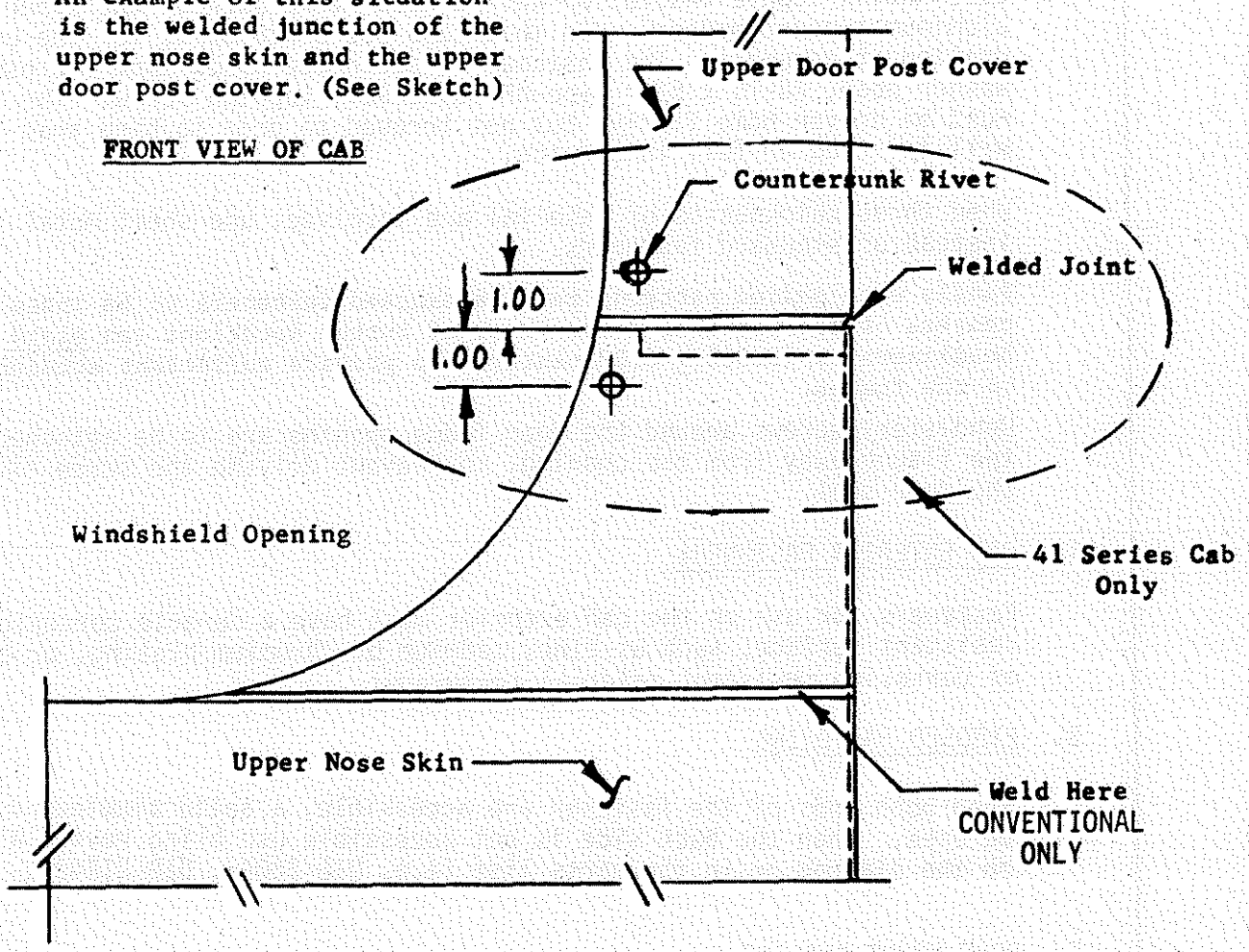
SPECIAL PRECAUTIONS

A. Rivets Near Weld

When a metal sheet joined by a weld must be fastened to another member, it is essential for the life of the joint to allow sufficient distance (about an inch) between the rivet, bolt, screw or the like, and the weld line.

An example of this situation is the welded junction of the upper nose skin and the upper door post cover. (See Sketch)

FRONT VIEW OF CAB



Example of fastener placement adjacent to a welded joint

B. FASTENING CAB LINING

Interior upholstery edges are to be fastened securely to upholstery strips and cab framing by Type -I cross recess (Phillips type) Black Oxide washer head #8-15 x 5/8" Type-BP point self-tapping screws spaced approximately 5" apart.

Cabs having double insulation have a wood strip between the liner and the aluminum support members. In this case use a #28 drill for the pilot hole drilled at assembly. The fastener is again the Black Type-I cross recess washer head, #8-15 x 5/8" Type-BP point self-tapping screw. The screw must be driven home firmly, but not torqued to grip so hard that the liner will twist up or fail in service.

When three thicknesses of material are involved, use sheet metal screws instead of standard fasteners.

Panels with padded patterns require exposed fasteners to be installed on centers of the fastener debosses or at button locations (on elite headliners on 15.000 ± 6.00 centers) to provide sufficient attachment to the frames.

Upholstery screws around the door frame opening are to be attached through the flange away from the opening, to prevent driving the screw tip through the door seal.

C. CAB EXTERIOR FASTENERS

Fasteners for use on the cab exterior must have a durable corrosion resistant surface, such as zinc, cadmium or chromium plating, or be made of corrosion resistant material throughout.

D. EXPOSED FASTENING

When both ends of the fastener are accessible, a solid aluminum rivet will be used. When the back side is not accessible use blind revits as listed on the diagram or in the parts list (i.e. D18-20095, D18-21740).

E. ROOF MOUNT SEALING

For additional sealing considerations see 33-18111 concerning roof mounted components.

F. STRUCTURAL RIVETING

Generally if the type of rivet is not specified on a drawing and there is access to both sides, the first choice of a rivet should be a 3/16 bucked brazier head rivet (23-09367-6XX). If there is a blind side clearance problem then the second choice of a rivet should be an Olympic (23-10871-608). Note - the 23-10871-608 has the correct grip range and head style to be used in most prepaint cab applications.

The Monobolt blind rivet (23-11052-#) should only be used where specified and installed as specified. It is a good structural rivet but does not work satisfactorily in light gage sheet metal. It will work when a washer is installed on the blind side or the material thickness on the blind side is greater than .125.

The Cherry-T rivet (23-09800) is not an approved rivet in structural applications because of fatique problems. The "Nail" blind rivet (23-09990) is a non-structural rivet and its use should be limited to non-structural applications.

All rivets in structural locations are to be 3/16 dia. (23-09367-6XX) installed per process specification 49-00040. Any defective rivets as noted in the process specification are to be replaced with good rivets. Oversize holes must have the modified brazier rivet (23-11634-8XX) installed to ensure a good structural joint.

F. STRUCTURAL RIVETING CONT.

All rivets in structural locations are to be 3/16 diameter as specified on the diagrams. These must be used in the following places: (Refer to illustrations on 33-18108, page 6 and 7).

1. Along top side beam, back beam and header beam.
2. Along door frame opening and nose beam.
3. Lap joints in front skins and back skin.
4. Rear uprights to skin and frame.
5. Tunnel assembly (COE only)
6. Fastening bunk to skin and to supporting angles (COE only)
7. Roof bows to roof skin.
8. Around deck flange, skin side, and roof skin assembly.
9. Back of cab reinforcement plate.

G. NON-STRUCTURAL RIVETING

Non-structural riveting will use 5/32 diameter soft rivets set in #21 drilled holes.

1. Baggage door frames
2. Air vents

H. RIVET LINE TOLERENCES

A. 1.25 spacing -
   1. $\pm$ .094 on rivet spacing along nominal centerline
   2. $\pm$ .062 on rivet location above or below nominal centerline with a maximum difference between any two adjacent rivets of .062

B. 2.50 Spacing -

   1. $\pm$ .125 on rivet spacing along nominal centerline
   2. $\pm$ .094 on rivet location above or below nominal centerline with a maximum difference between any two adjacent rivets of .094

C. Patterns greater than 2.50

   1. $\pm$ .125 on rivet spacing along nominal centerline
   2. $\pm$ .125 on rivet location above or below nominal centerline

Piece parts which have prepunched/drilled pilot holes would have a G.D.T. control of

J. RIVETING MALLEABLE, SOFT OR BRITTLE MATERIALS

When joining materials that require good load distribution to develop maximum strength at the point of fastening, it is usually necessary to use some type of washer or fastening strip at one or both ends of the rivet. The inside diameter of such washers should closely approximate the design size of the rivet hole through the materials to be joined--failure to observe this practice may result in steps in the shank and a weaker joint.

K. LOCK BOLTS

(Refer to Diagrams on 33-18108 pg. 6 & 7, see usage information on 33-00109, page 9.)
Lockbolt fasteners are to be installed in the following locations:

1. Front cab mounts to decks/noseskins
2. Front cab mounts to tunnel/firewall (Conv. only)
3. Decks/deck angles to tunnel.
4. Door opening frame brackets to deck.
5. Rear cab mounts to decks/tunnel.
6. Rear cab mounts to B.O.C. reinforcement plate. (COE ONLY)
7. Ladder step brackets to decks (COE only)
8. Deck Z-Angles to Decks (96 & 104 COES only)
9. Rear Deck Angels to Decks
10. Steel center skin (COE only)
11. Rear deck angles to rear cab mounts

L. SPECIAL SITUATIONS

1. COE

a. The tunnel transition plate rivets are to be spaced on 1.25 inch centers all around the plate 1/2 inch in from the edge.

b. Lockbolts and rivets used on all other tunnel fastening will be on 2.50 inch centers unless located by a controlling piece part.

Examples:

1. Rough services angle, LH & RH
2. Cab supports, front & rear, LH & RH

L. SPECIAL SITUATIONS (CONT.)

c. In the area of the RH Tunnel Blister, lockbolts will be installed with a fender washer beneath the retainer ring wherever it would face on aluminum.

d. When the upholstery strips are installed on the backskin there should be enough adhesive to ensure a good structural bond and have 3/16 bucked rivets set at the ends of the strips and one rivet somewhere near the center in one of the prepunched holes.

2. CONVENTIONAL FIREWALL

a. CENTER FIREWALL TO NOSEBEAM

Back-drill .281 (+.008, -.002) Dia holes through the center firewall top flange and nosebeam bottom surface and install Huck B.O.M. blind rivets 23-11483-003. Make sure center firewall is tight against the nosebeam bottom surface.

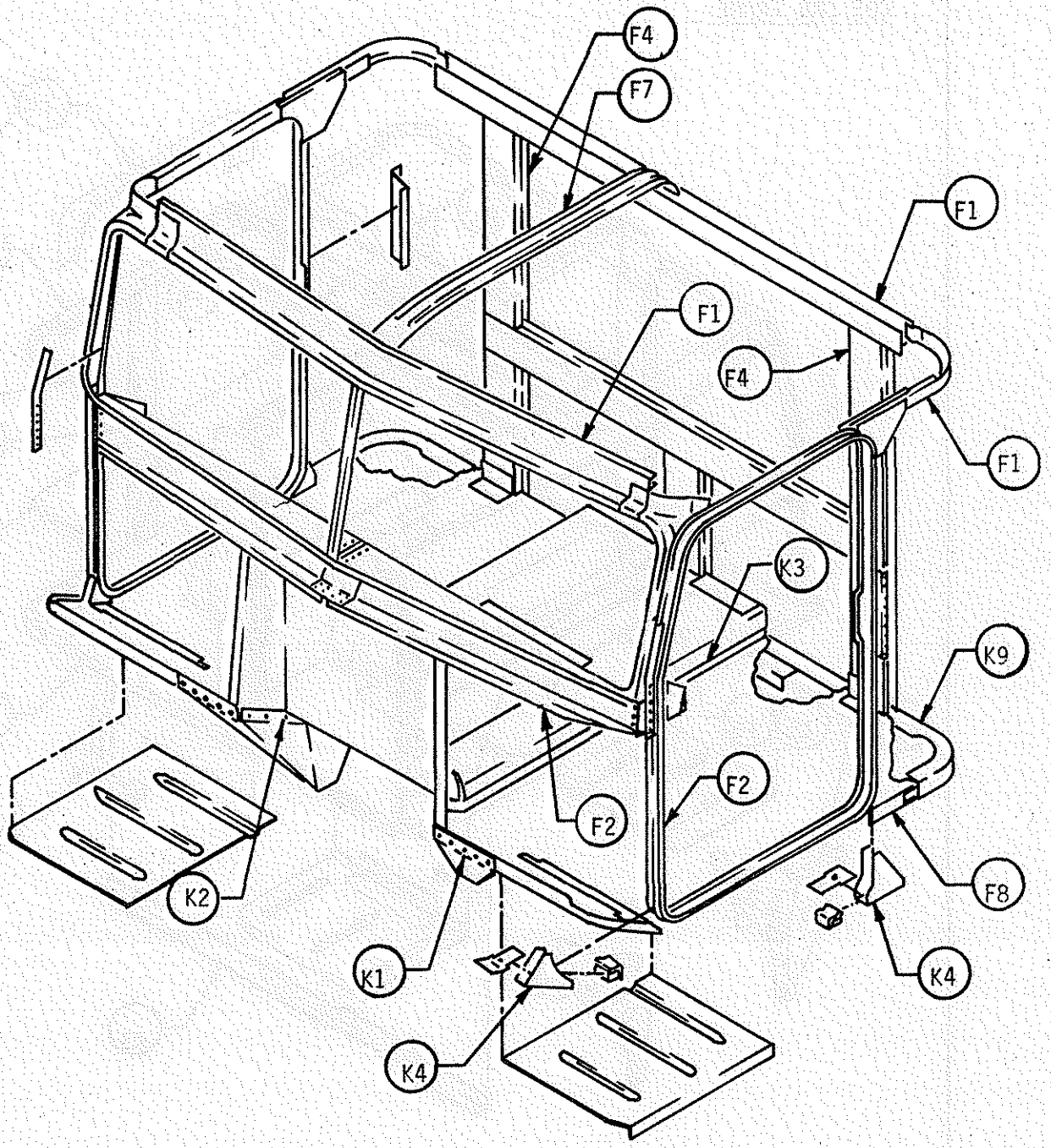
c. NOSESKIN

Back-drill .191" (+.008", -.002") diameter holes through the holes in each side flange of the firewall and install Brazier head rivets. (Ref. 23-9367-608)

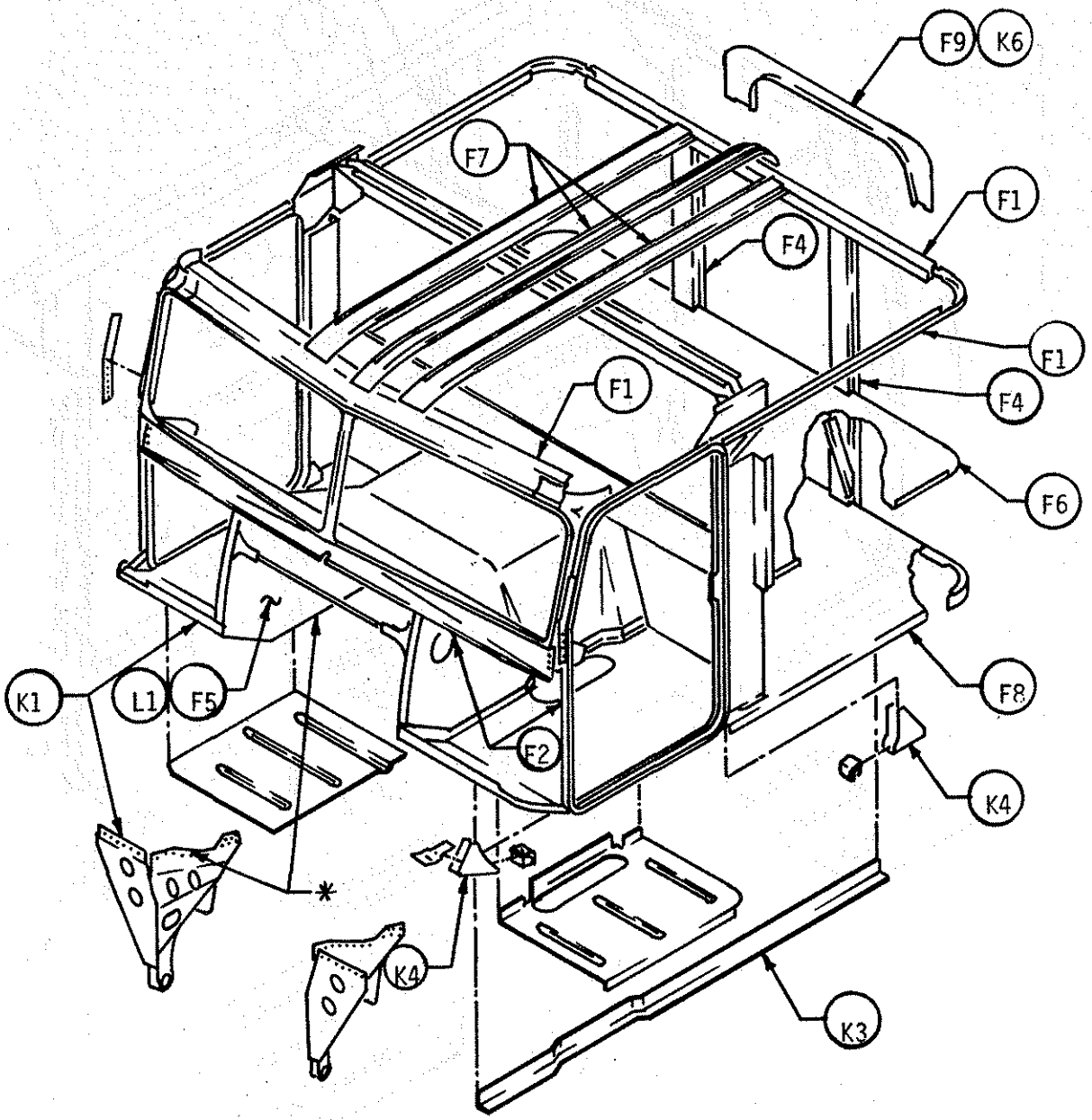
d. TUNNEL

Back-drill .191" (+.008", -.002) diameter holes through the lowest flange of the firewall and install Brazier head rivets. (Ref. 23-9367-608)

CONVENTIONAL CAB FRAME



COE CAB FRAME



* SEE SHOP PRACTICE 33-18102

Compiled	F. FREER	SHOP PRACTICE	33-18109
Approved	BEL	TORQUING OF SCREW FASTENERS	
Issued	12-16-65		
Revised	11-11-85 Chg Lt N	FREIGHTLINER CORPORATION PORTLAND, OREGON	

SPECIAL VALUES: For the fasteners listed, use the indicated torque values.

FASTENER	THREAD SIZE	GRADE BOLT MAT'L	TORQUE FT-LB	REMARKS
Cab Pivot Bolt	5/8 - 18 UNF	8	75-125	Urethane Bushing
Cab Mount Bolts, Rear Frame Rail Casting	1/2 -13UNC	8	95± 20	
Cab Front Support Bolts	3/8-16 UNC	8.2	40 ± 10	
Cab Isolators, Front Conv. Rear	1/2-20 UNF 5/8-11 UNC	8 8	100 ± 5 100 ± 5	
40" Sleeper Box	1/2-20 UNF	8	240 ± 25	
60" Sleeper Box Front Rear	5/8-11 3/4-10	8	285 ± 25	

GENERAL VALUES: See 33-00109.

N

Compiled	BLAKEWOOD	SHOP PRACTICE CAB, NOISE INSULATION	33-18110
Approved	DRS		
Issued	11-27-78		
Revised	11-18-81	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 1

A.

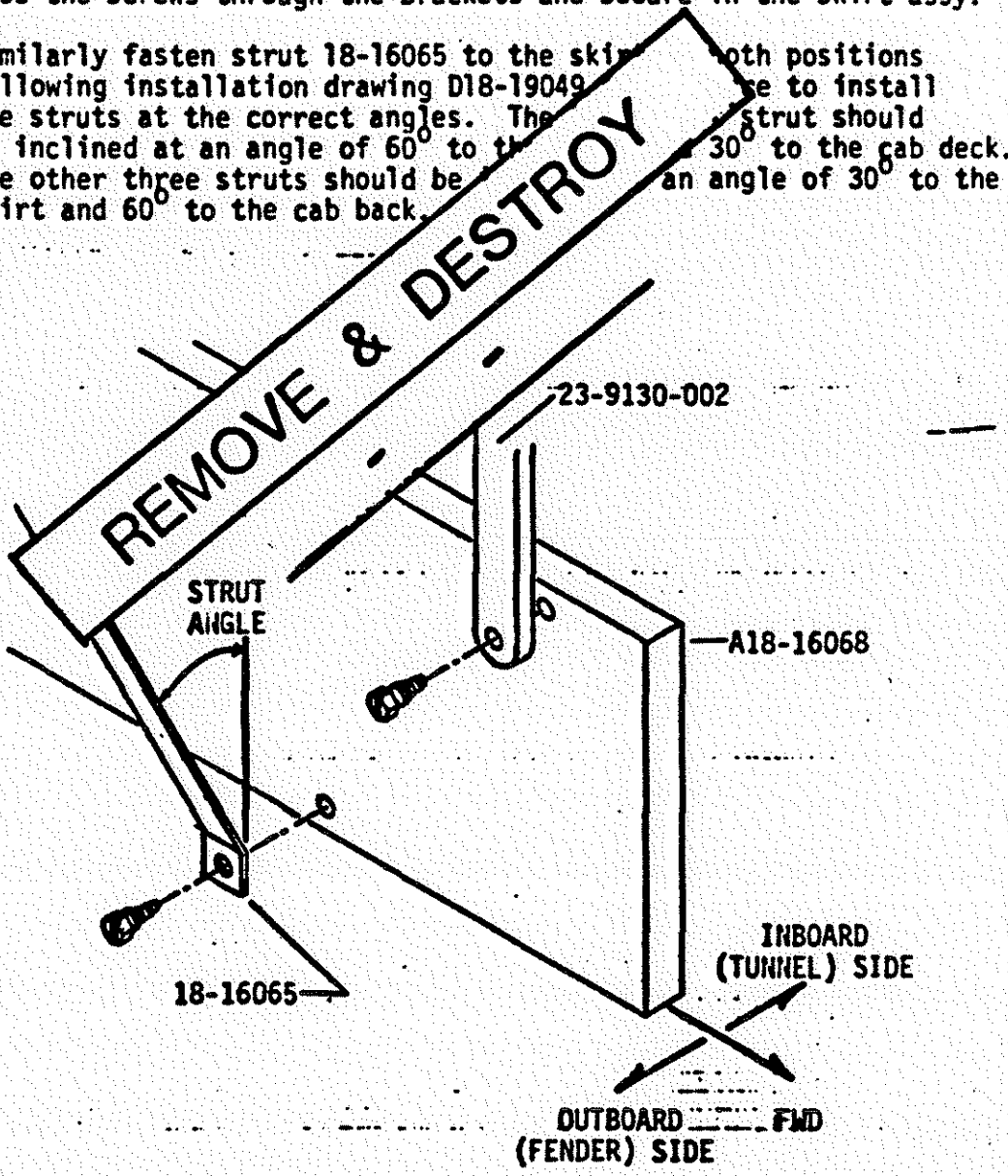
A. NOISE SKIRT

The noise skirt assemblies are to be installed as follows:

1. Align holes in top of noise skirt with holes in mounting brackets 23-9130-002 with the skirt inboard of the brackets.

2. Pass the screws through the brackets and secure in the skirt assy.

3. Similarly fasten strut 18-16065 to the skirt in both positions following installation drawing D18-19049 ... to install the struts at the correct angles. The ... strut should be inclined at an angle of 60° to th... 30° to the cab deck. The other three struts should be ... an angle of 30° to the skirt and 60° to the cab back.



A

B. ACOUSTIC (SOUND) LINER INSTALLATION

The sound liner when installed in C.O.E. tunnel or Conventional hood is retained with double stick pressure sensitive adhesive tape and in the C.O.E. aluminum retainer strips front and rear.

Once the sound liner has been cut to shape and the edges bound with Mylar tape (Note Figure # 1) per print, lay the liner shiny face down. Around the back edge of the part apply adhesive tape. Then apply strips of tape every 6" to 8" (Note Figure # 2) running parallel to the radius that the part may have to have formed at installation. Use application rollers to exert pressure to attach tape to liner do not overlap the tape and do not remove backing until ready to install liner on the vehicle.

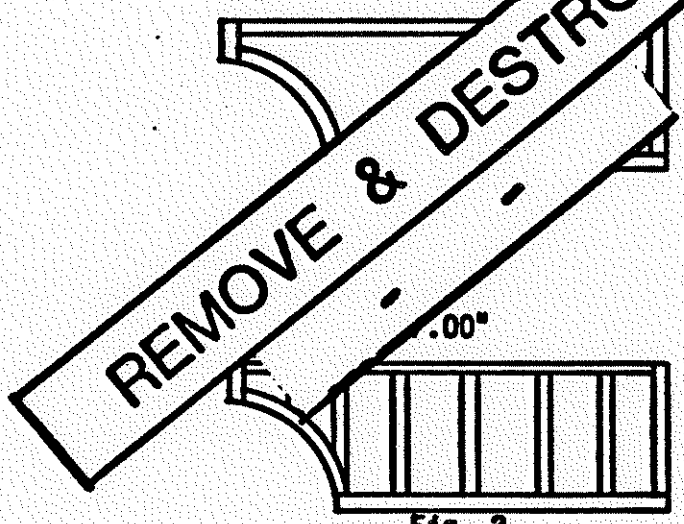


Fig. 2

When ready to install the sound liner remove the tape backing strip from tape and position the liner, pressing lightly working your way up. Once the liner is correctly positioned exert HEAVY pressure using application roller. This tape is pressure sensitive adhesive and heavy pressure is required at application for proper adhesion.

On C.O.E. tunnel installations select the appropriate front and rear retainer strips and bend to match contour of tunnel. Back drill Per. D18-19049 and rivet.

COMPILED	K R H	SHOP PRACTICE CAB SEALING	SECTION NUMBER 33-18111
APPRV	HADLOCK		
ISSUE DATE	05/01/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-004 FOR CAB SEALING PROCEDURE.

A. Use of Sealants

Shop is to apply foam tape, caulking compound and anti-corrosion compound according to instructions in D18-18998 for COE, and D18-19738 for Conventional.

Approved Sealants

1. Foam Sealing Tape:

   With E-COAT - 48-02454
   Without E-COAT - 48-00050 or 48-02454

2. Caulking Material:

   With E-COAT - 48-00094-530, 531
   Without or After E-COAT - 48-00118, 48-00094-520, 601

3. Anti-Corrosion Compound:

   With E-COAT - 48-00094-530, 531
   Without or After E-COAT - 48-00119, 48-00094-520

4. Interior Roof Sealant

   After E-COAT - 48-00094-801

   Spray the inside of the roof covering the following areas:

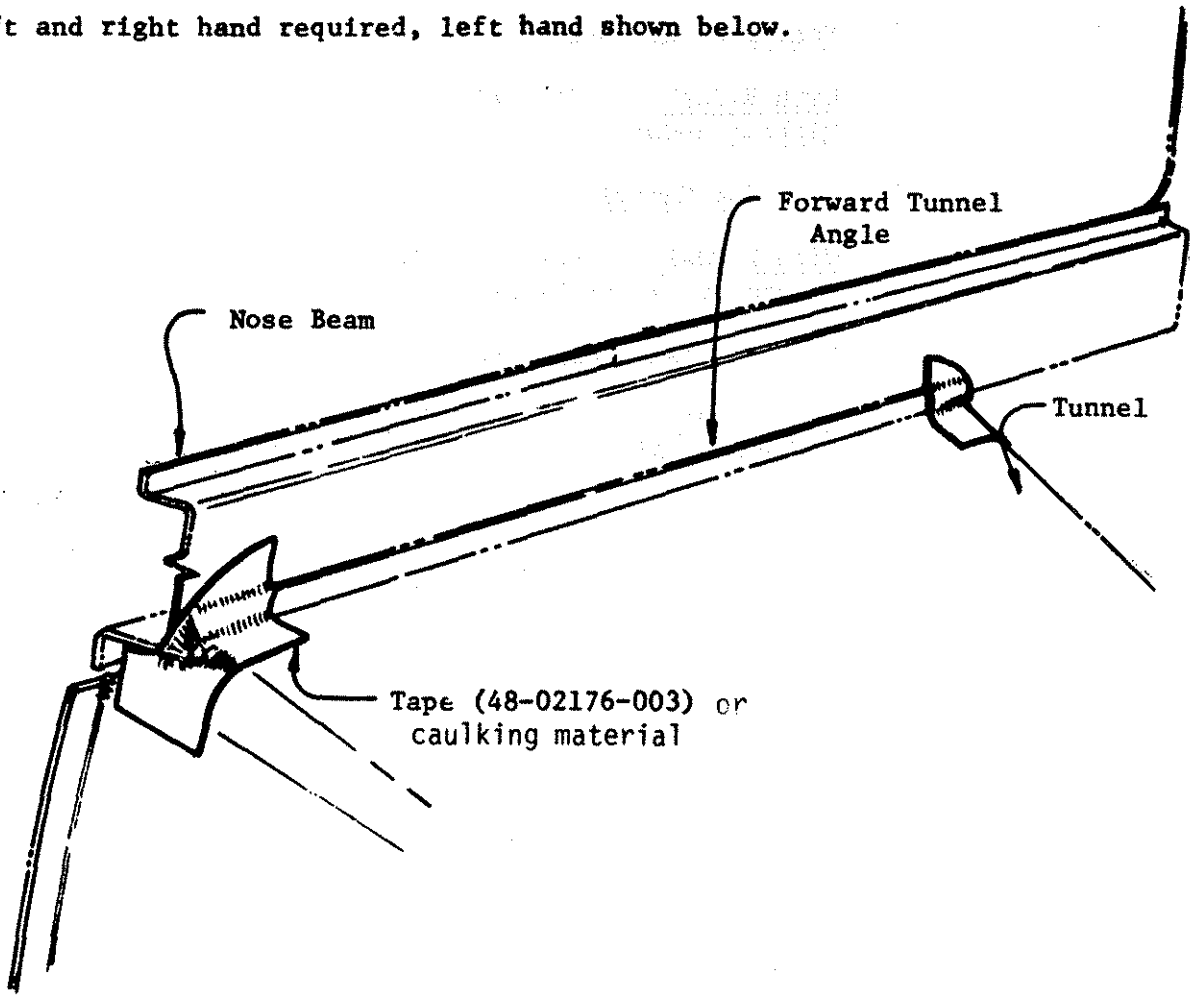
   - All rivet ends.
   - All exposed aluminum that isn't covered by insulation.
   - All corner cap seams.
   - All lap seams between the roof skins and the inner roof structures.

NOTE: Silicone Sealers are not to be used prior to E-COAT.

B. TUNNEL-NOSE BEAM SEALING

Cover area shown by wrapping about 6 inches of 3 inch wide tape (Pressure sensitive foil tape, (Ref. 48-02176-003.) around the corner from tunnel top to tunnel side, making sure the tape fits tight against the nose beam and tunnel side to seal completely.

Left and right hand required, left hand shown below.



A

REVISED & RETYPED "C" CHG

(Continued)

ROOF MOUNTED AIR HORNS, BULLET MARKER AND PEDESTAL MARKER LIGHTS, ETC

To ensure that the components mounted on the cab roof do not provide a path for water to leak into the cab, observe the following:

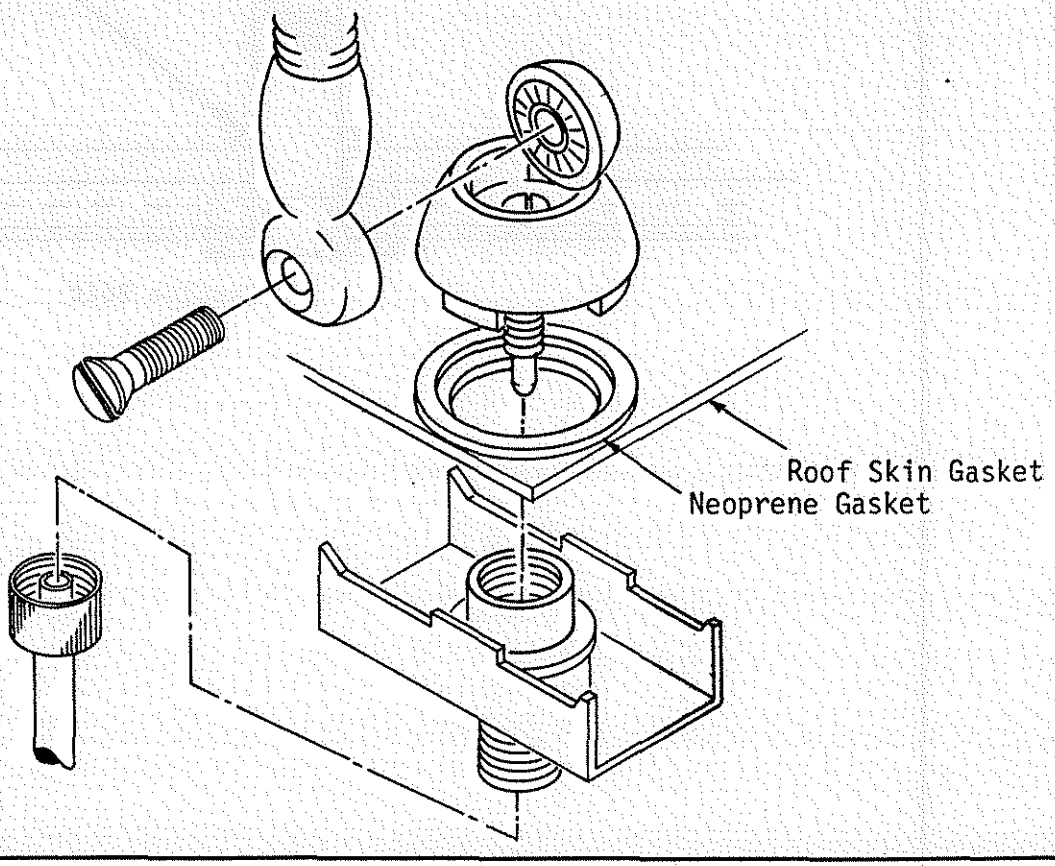
1. After mounting holes have been located, drilled and rivnuts installed, encircle them with a ¼ inch wide bead of silicone rubber #732.

2. On bullet marker light, install 23-10998-000 grommet over the wire before mounting.

3. A On air horn, make sure that front and rear pedestal gasket and flat fiber washer (23-09428-000) are installed; in case of air horn with snow guard, place front pedestal gasket beneath the aluminum spacer (22-15510) and apply silicone rubber #732.

4. An antenna installation requires a 23-09180-039 grommet at each metal web hole it passes through on it's way to the radio receiver. The antenna lead must be installed by hand after the base and clamp are assembled. Fastening screw must be tight.

5. After components are installed, interior of the roof skin is to be covered with a layer of silicone rubber sealant, in the area of all rivnuts, wire or air line holes to insure a water tight seal.



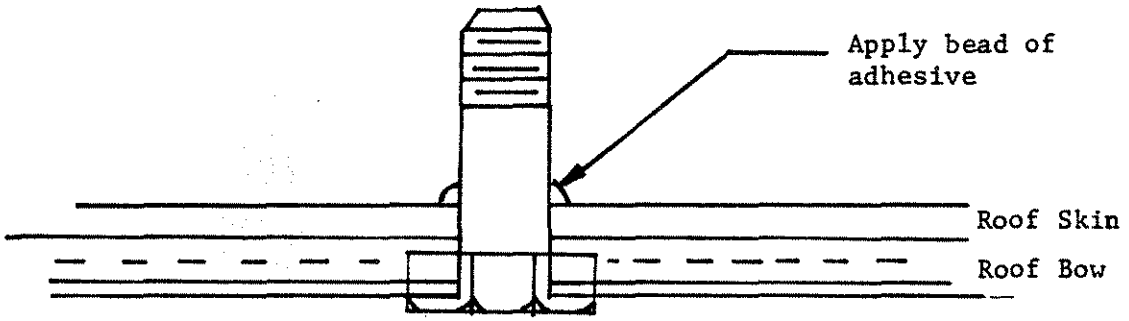
6. On roof mounted condenser (See Figure 5, Page 5), silicone rubber sealant must be applied at the following: Contacting surfaces between the roof and rubber cushions (Red Dot), Mounting brackets (Kysor), Hose clamps, and also at mounting bolt heads and rubber grommet where power cable getting into cab (23-10998-10).

7. Air Shield and Roof Fairing Brackets:

   Sealant must be applied where all air fairing or air deflector fasteners penetrate the roof and back skin. Appropriate sealants are:

   48-00094-520 Portland and Canada
   48-00094-530 Mt. Holly
   48-00094-531 Mt. Holly

   Example:



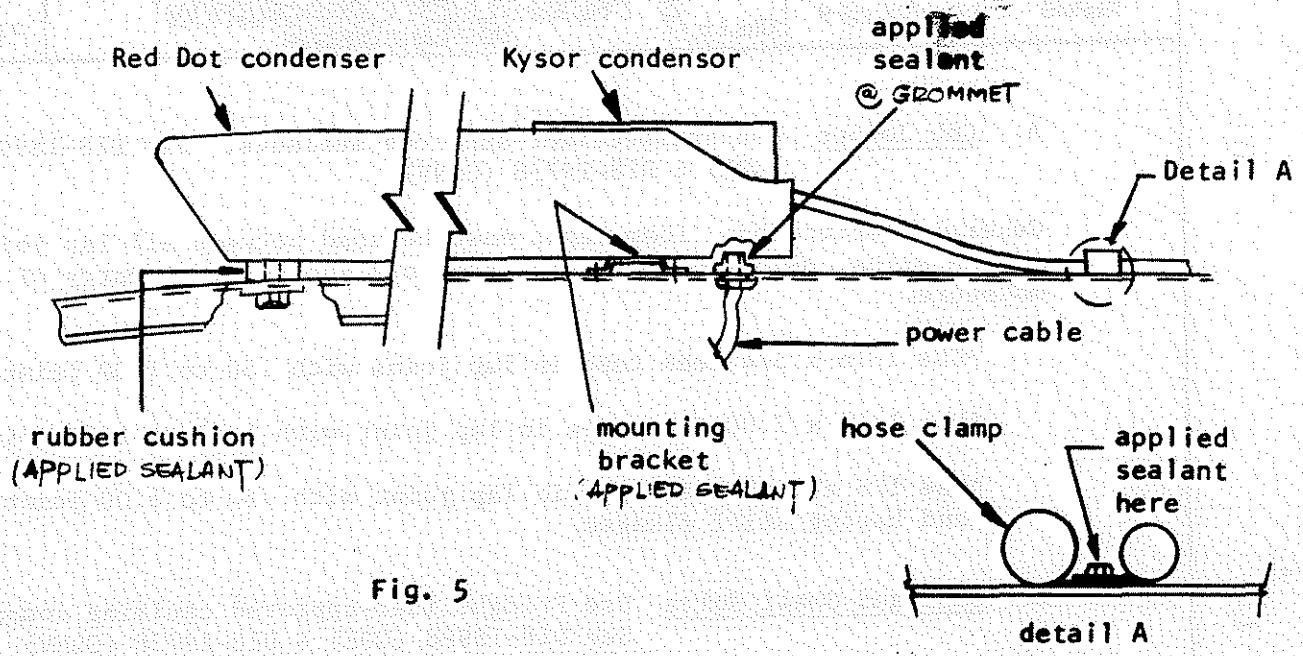

Red Dot condenser
Kysor condensor
applied sealant @ GROMMET
Detail A
power cable
rubber cushion (APPLIED SEALANT)
mounting bracket (APPLIED SEALANT)
hose clamp
applied sealant here
detail A

Fig. 5

A. Cab Joints Use Freightliner-approved sealants. See D18-18998 (COE) & D18-19738 (CONV).

General Instruction: foam tapes must be used between all lap joints such as cab skins, skin and deck, etc. that are subjected to entry of air and moisture.

*Use 1/16 x 3/4 foam tape in lap joins with .50 to 1.00 joint width.

*Use 1/16 x 2.00 foam tape in lap joint with 1.50 to 2.00 joint width.

*Use 1/8 x 1.00 foam tape in lap joint with .50 to 1.00 joint width and having stiff flanges.

B. Gaps and Small Holes Use Freightliner-approved caulking compound. See D18-18998 (COE) & D18-19738 (CONV).

General Instruction: caulking compound must be used to fill up all exposed holes or gaps, electrical grommets, etc. that are subjected to entry of air and moisture. It should be applied after E-COAT and prior to top coat. It should also be remembered that although the paint can harden normally, the caulking material will not, and it will thus give little or no support to the paint film.

C. Weather Seal Use Freightliner-approved sealants, after E-COAT process.
*3M-101 (48-094-401)
*Silicone rubber one part sealer (49-094-501)
See 33-18111 for more detail.

As a general rule, aerosol silicone sealers or other products are not to be used because surfaces contaminated with silicones are very difficult to clean enough for a good paint bond. Repainting is apt to be difficult if the old paint surface has ever been exposed to silicones. Their use should be confined to the finish cab line.

D. PIPE THREADS

In most sealing situations involving pipe threads the **liquid** type of sealant should be used. When a difficult sealing problem is encountered, the situation should be referred to Engineering through the usual channels for specific recommendations. (Use pipe sealant, spec. 48-00094.)

Always apply the liquid sealant to the external thread, so that any excess will be scraped off externally rather than internally to the joint

For sealing situations known to be difficult, such as power steering hydraulic lines, when the system is tested after installation, "Locite" hydraulic sealant should be used. (Ref. 48-00094)

In any case, the manufacturer's directions for use should be followed carefully and care should be taken to avoid entrance of excess sealant from the joint into the system.

REVISED & RETYPED ' ' CHANGE

COMPILED	H J R	SHOP PRACTICE CAB INSULATION	SECTION NUMBER 33-18112
APPRV	TRAUB		
ISSUE DATE	01/16/68		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	E		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-005 FOR CAB INSULATION PROCEDURE.

Compiled	H.J.R.	SHOP PRACTICE CAB INSULATION	33-18112
Approved	TRAUB		
Issued	1-16-68		
Revised	4-15-83	Chg Ltr D	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

A. GENERAL

The importance of good insulation in the cab cannot be over-emphasized. A well insulated cab may sometimes mean the difference between a satisfied customer and one who will buy elsewhere next time.

B. TREATMENT OF THE VARIOUS CAB AREAS WILL BE AS FOLLOWS:

1. Noseskin Area: The insulation must cover completely from door post to tunnel side and from forward deck flange to bottom of the nosebeam.

2. Backskin Area: Insulation in this area goes from the bunk to the bottom of the rear beam, and from the back of the rear door post all the way around the cab to the opposite door post. It must completely fill areas between upholstery strips and around obstacles such as exhaust wells and air intake snorkels.

3. Baggage Compartement: Insulation must be as complete in the baggage compartment as in any other area. Insulation must reach from the deck level to the bottom of the bunk and from the door post to the tunnel side.

4. Roof Skin: Insulation must cover areas bounded by header, lintels and curtain bow. (Rear beam if applicable.) Care should be taken to fill all areas between roof bows and upholstery strips.

5. Miscellaneous: Deviations from the above may occur in case of certain optional cab equipment, but as a general rule any metal exposed to the outside should be covered by insulation on the inside.

REVISED & RETYPED "C" CHG

Compiled	G.Streaty	SHOP PRACTICE CAB PRIMING AND PAINTING	33-18113
Approved	DAVE		
Issued	3/2/70	Chg Ltr	
Revised	4-4-80	FREIGHTLINER CORPORATION PORTLAND, OREGON	

A. Paint Procedure and Thickness

1. The total paint thickness for the cab is:

   2.4 to 3.2 mils for solid colors (916Y and Imron)
   3.0 to 3.7 mils for metallics (Imron)
   3.3 to 6.9 mils for poor hiding metallics (Imron)

   The primer coat shall make up .6 to 1.0 mils of the total thickness.

2. The procedure to follow in achieving a quality top coat application is as follows:

   a. Sand and deburr cab area of defects and protrusions
   b. Solvent clean
   c. Rinse
   d. Iron phosphate
   e. Rinse
   f. Chromate conversion coat
   g. Rinse
   h. Oven dry
   i. Prime with DuPont corlar epoxy primer (.6 to 1.0 thick)
   j. Mask (for each color)
   k. Paint interior with 916 TAE only (1.8 to 2.2 thick)
   l. Air dry or oven cure
   m. Paint exterior with 916Y TAE or Imron enamel.

B. Masking

The following lists the major places on the cab that must be masked against painting. (Ref. 33-00113):

1. Door glass.
2. Door latch and wood grain area.
3. Cab box step

REVISED & REPRINTED - CHANGE K

Compiled	F.Freer	SHOP PRACTICE CEMENTING ABS	33-18114
Approved	DRS		
Issued	4-4-80		
Revised		Chg Ltr	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

Cementing ABS Plastics

1. Purpose

For bonding reinforcements in areas of stress and to repair tears, cracks or splits.

This procedure is only for bonding an ABS plastic to itself. Do not attempt to join different materials to each other by this method.

2. Cementing Agent

Methyl-ethyl-keytone (M-E-K) is a solvent for softening the surfaces to be joined.

3. Procedure

With a small paint brush, apply M-E-K to both surfaces to be bonded. Speed is important as this solvent evaporates quite rapidly. When both surfaces are tacky, press them together. Do not flex the area for at least 15 minutes after bonding. For best results, the bonded area should be clamped for 15 minutes after applying the reinforcement.

COMPILED	DANG	SHOP PRACTICE	SECTION NUMBER 33-18115
APPRV	D L		
ISSUE DATE	12/14/70	WINDSHIELD AND WINDOW	
REV DATE	07/29/96		PAGE 1 OF 1
CHG LTR	R	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-006/007/008 FOR CAB WINDSHIELD, CAB WINDOW, LOWER DOOR, AND CAB REAR WINDOW.

Compiled	DANG	SHOP PRACTICE WINDSHIELD & WINDOW	33-18115
Approved	D.L.		
Issued	12-14-70		
Revised	6-9-94	Chg Ltr F **FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 1

F

1. INSTALLING ALL REAR WINDOWS

A. After installation of the seal bond the mating ends together with 3M # 031135-0813 adhesive.

B. Apply windshield sealant (ref. 3M #5537) in an amount of no less than a one-eighth inch bead to the glass channel and an eighth inch bead to the cab skin channel of the rubber molding. The stated bead size should be maintained by regulating the pump pressure and, frequently, checking samples during the period of application. The beads and seal configuration must look like figure 1.

C. Start at the center of the bottom edge, install the windshield rubber molding, overlapping cab skin with the narrow, deep slot of the molding. Be sure to get molding well up into the corners.

Continue sliding molding along the window edge until the ends of the molding overlap. Cut the overlap down to about one inch. Smear one end of the molding with weatherstrip adhesive. Compress the molding and butt the ends together. Push the molding joint down over the skin.

D. Insert the glass in the molding along the bottom edge. Push down on glass to make sure it seats properly. Then push the top of the glass against the molding, and with a cotter key extracter inserted between the rubber and the glass where the glass is already seated in the molding, wedge the glass into the molding all around. Tap lightly the upper corners of the glass so that it seats properly. With the cotter key extracter still inserted between the glass and the rubber, continue around window once more to be sure window is seated.

E. Inspect area 1 (Fig. 2); If no sealant is present, add an extra one sixteenth inch bead of sealant.

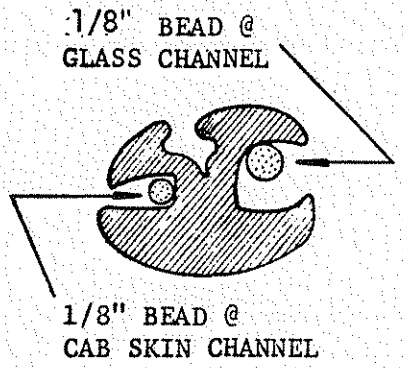


FIGURE 1
(True Size)

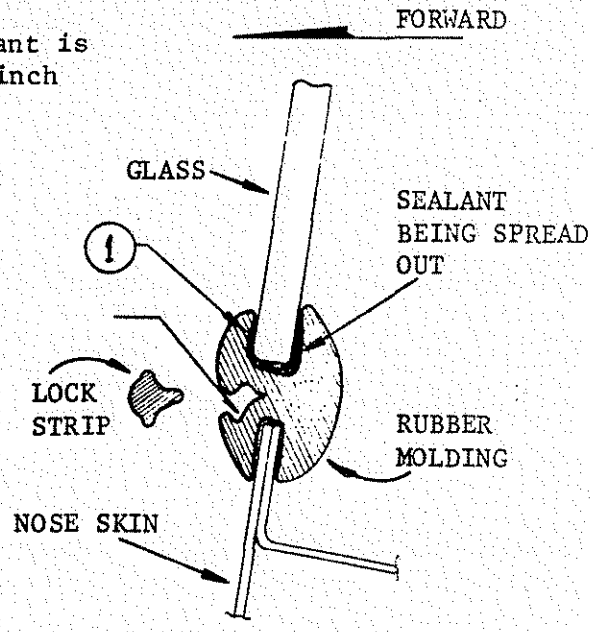


FIGURE 2

OLD PAGE DELETED, PAGE NUMBERS ADVANCED, F/ CHANGE

P

1. INSTALLING ALL REAR WINDOWS (continued)

F. Lubricate the lock strip channel with "Glass Slip".

G. Attach air operated vibrator (suction cups) to center of glass. Attach air lines and start. Starting at the center of the top edge, and using the inserting tool, insert the lock strip into the pre-lubricated channel. Vibrate the window for about two more minutes, remove vibrator and with a clean, dry cloth wipe off excess sealer except at the molding joint.

PAGE NUMBER ADVANCED, 'P' CHANGE

2. INSTALLING THE WINDSHIELD GLASS (continued...)

B F. Lubricate the lock strip channel with "Glass Slip".

B G. Attach air operated vibrator (suction cups) to center of glass. Attach air lines and start. Starting at the center of the top edge, and using the inserting tool, insert the lock strip into the pre-lubricated channel. Vibrate the window for about two more minutes. Remove vibrator and with a clean, dry cloth wipe off excess sealer from the molding joint.

REMOVE & DESTROY

K 2. INSTALLATION OF WINDSHIELD SEAL AND GLASS, C.O.E. & CONVENTIONAL

To insure against any water leaks around the windshield opening . The following items must be strictly followed.

A. Gap between seal and inner flange must be kept to a minumum. This is accomplished by pressing windshield into opening (see fig. 1).

B. Both seal wipers must be facing in the proper direction (see fig. 1).

C. Distance between glass and base of offset should be constant around windshield opening (see fig. 1).

D. Soap and water (only) may be used as a lubricant to aid windshield installation.

J

K 3. Installing the Lower Door Window Glass

A. Using no sealant install the window rubber molding starting at the center of the rear edge, overlapping the door skin with the narrow, deep slot of the molding. Be sure to get molding well up into the corners. Continue sliding the molding over the window opening edge until the ends of the molding overlap. Cut the overlap down to ½ inch. Coat one end with weather strip adhesive, compress the molding and but the ends together. Push the molding joint down over the skin.

B. Insert glass as in 2, C. above.

C. Lubricate the lock strip channel with "Glass Slip" or soap & water.

D. Starting at the butt seam, install the locking strip using the inserting tool.

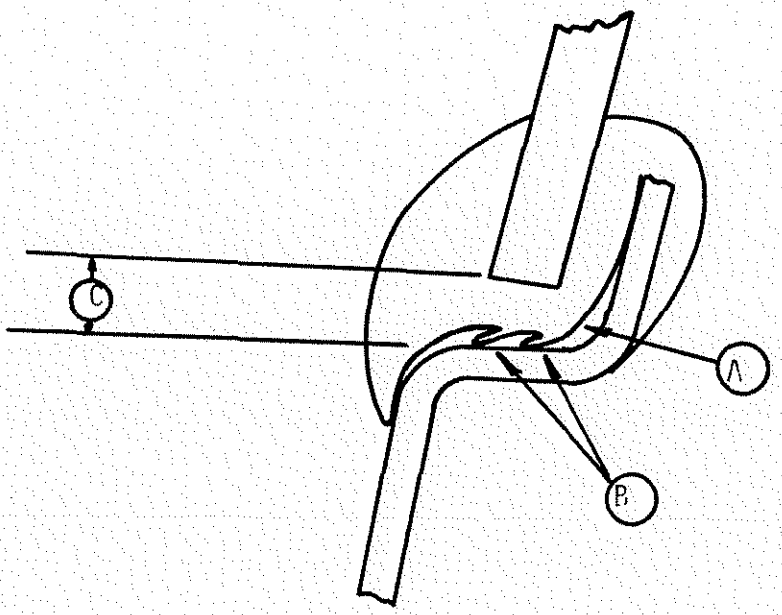


Figure 1

Revised & Retyped ' ' Change

COMPILED	CARSON	SHOP PRACTICE BAGGAGE DOOR INSTALLATION LATCH	SECTION NUMBER 33-18116
APPRV	D SEEMEN		
ISSUE DATE	08/11/69		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-009/010 FOR BAGGAGE DOOR LATCH (PULL CABLE/PADDLE TYPE) INSTALLATION PROCEDURE.

Compiled	CARSON	SHOP PRACTICE BAGGAGE DOOR INSTALLATION LATCH	33-18116
Approved	GEH D. Seaman		
Issued	8/11/69		Page 1 of 2
Revised	9-18-81	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-27

A. FASTENING PULL-CABLE ON REMOTE CONTROL BAGGAGE DOOR

Fasten the pull-cable terminal fitting to the latch handle by means of a 3/16" hard aluminum brazier head rivet. This rivet must have a loose press fit in the hole in the handle and be loosely bucked to allow free rotation of the eye of the cable end fitting under the rivet h
(See Fig. 1 & 2)
(Ref. D22-11431)

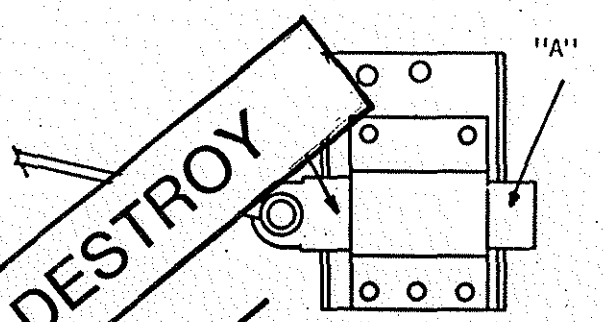


Fig. 1

REMOVE & DESTROY

B. LUBRICAT

Apply sma nt of lubricant at points (Lubriplate or equivalent) to fore and aft portion of slide bar. (See Fig. 1)

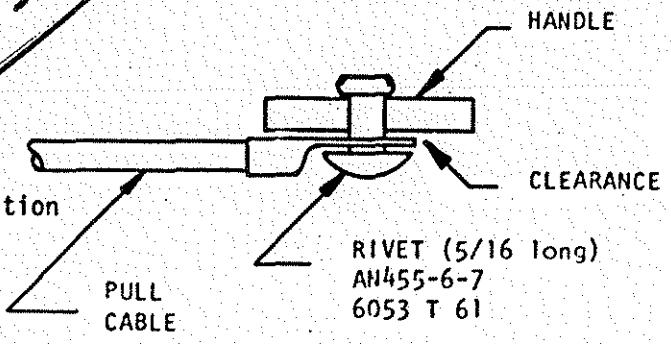


Fig. 2

C. RELEASE CABLE CLAMP

Locate the baggage door release cable clamp in the pre-punched hole in the rear door post as shown below.

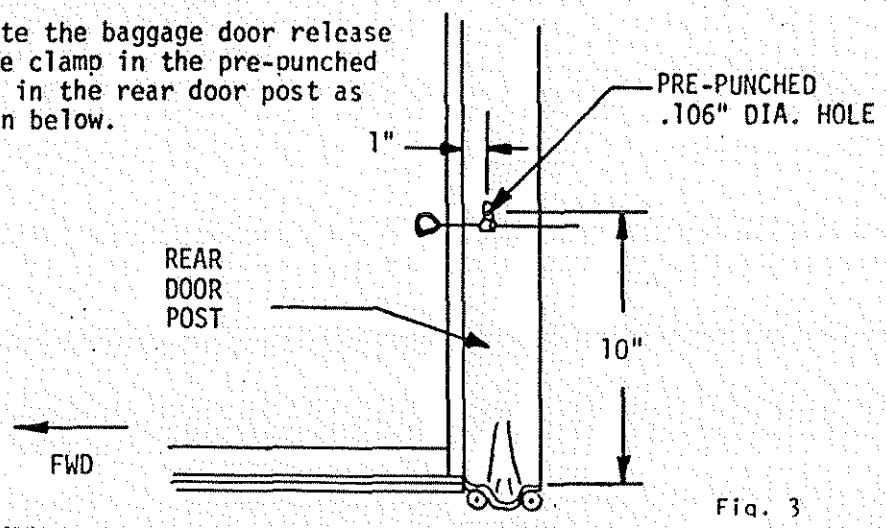


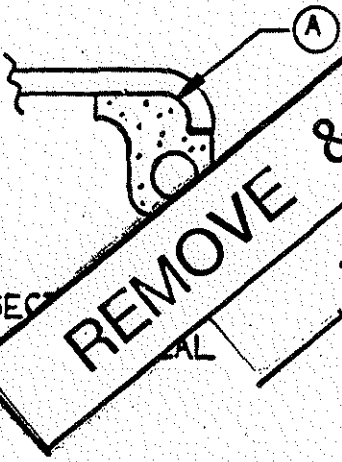
Fig. 3

Compiled	T. Campbell	SHOP PRACTICE BAGGAGE DOOR INSTALLATION SEAL	33-18116
Approved	T. Campbell		
Issued	9-18-81		Page 2 of 2
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-27

SEAL INSTALLATION

REMOVE & DESTROY

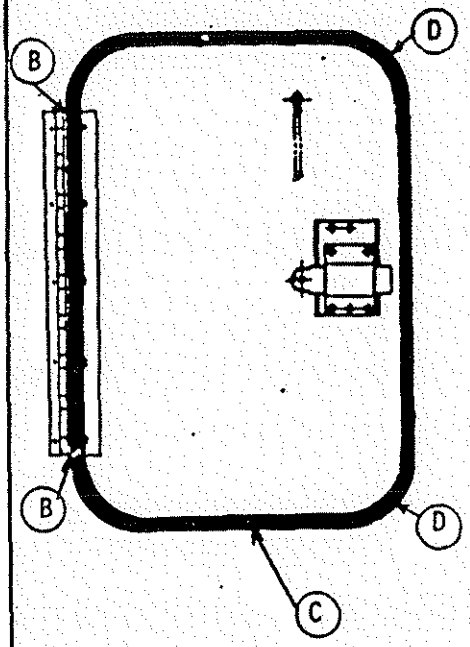
A. ...General Trim Adhesive on ...side edge of panel radius and ...nge and mating surface of seal.



B. Apply extra adhesive to seal area of hinge leaf to panel overlap.

C. Locate butt splice at bottom of panel adhering ends together.

D. When installing seal take care not to stretch excessivly to avoid pulling seal in at the corners.

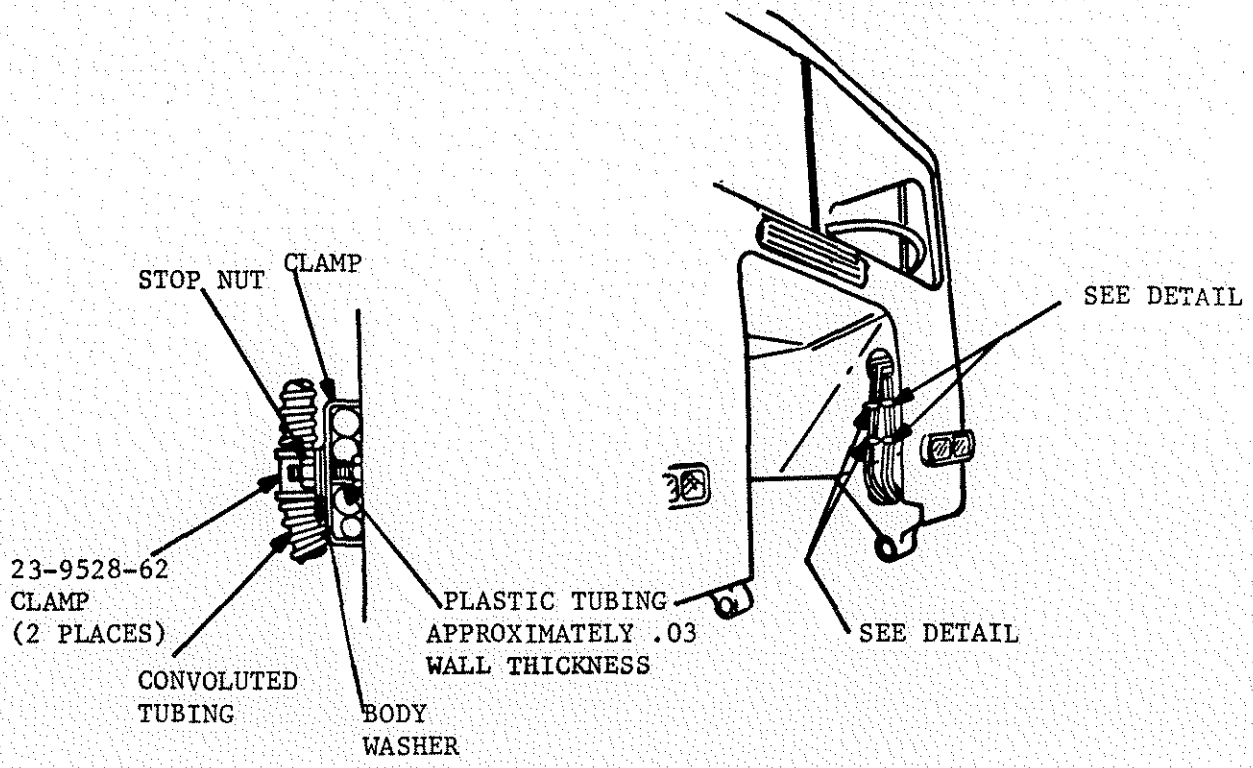


COMPILED	F F	SHOP PRACTICE PROTECTION OF AIR LINES	SECTION NUMBER 33-18117
APPRV	B A M		
ISSUE DATE	04/04/80		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-011 FOR AIR LINE PROTECTION PROCEDURE.

A

B



FRONT LH ENGINE SIDE OF TUNNEL

HOSE CLAMPING FROM LH CAB AIR JUNCTION BLOCK

The air lines that pass up the forward LH engine side of the tunnel must be held away from abrasive objects that can cause chafing. Clamp hoses in position as shown above, using the mounting stud provided.

NOTE: The plastic tubing inserted over the mounting stud to prevent wear and chafing to hoses.

Because of the sloted mounting hose on the clamp body, washers must be used under the stop nuts. (Do Not use plain nuts in this application.)

COMPILED	T. YOUNG	SHOP PRACTICE LABEL INSTALLATION, CAB	SECTION NUMBER 33-18118
APPRV	L. HISER		
ISSUE DATE	12/10/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	S		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-012 FOR CAB LABEL INSTALATION PROCEDURE.

Compiled	T. YOUNG	SHOP PRACTICE CAB LABEL INSTALLATION	33-18118
Approved	LOUTZENHISER		
Issued	8-19-68		
Revised	12-10-85 Chg Ltr N	FREIGHTLINER CORPORATION PORTLAND, OREGON	

The following locations are to be used for the instruction decals unless instructed otherwise via the spec sheet.

N

LABEL	LOCATION
Noise Emission	On the RH top surface of the nose beam between the dash and the windshield mask.
Vehicle component information (inc. Gliders)	COE - In manifest box. CONV - Glove box bottom shelf (Dash Section D)

Compiled	N RITCHIE	SHOP PRACTICE KEY CODE LABEL	33-18119
Approved	E. TRAUB		
Issued	3-27-74		
Revised		Chg Ltr	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

KEY CODE LABEL

The key code label is to enable the operator to have a new key made if he is locked out.

A. Location
The label is to be fastened to the front surface of the driver's cowl. Locate it 6.00 in from the left edge of the cowl and 1.50" up from the nosebeam trim. The letters are to face forward so that it can be read from the outside.

B. Fastening
The label is to be fastened with two black anodized aluminum blind rivets number 23-9990-004.

COMPILED	R D F	SHOP PRACTICE CAB TILT SYSTEM	SECTION NUMBER 33-18120
APPRV	K R H		
ISSUE DATE	11/11/85		PAGE 1 OF 1
REV DATE	07/29/96		
CHG LTR	B	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-013 FOR CAB TILT SYSTEM PROCEDURE.

A. SET-UP OF VACUUM-FILL:

1. Pressure pump must be set between .33 and .40 GPM. Connect pump to oil inlet on vacuum-fill stand. Relief valve should be set to 125 PSI.

2. Hand pump on truck should have spool handle in lower position.

3. Plug in power cord; system is now ready.

B. OPERATION OF VACUUM-FILL:

1. Insert clamp into fill hole and secure. Clamp must be tight to pump.

2. Push power start switch; system is now ready to start.

3. Push cycle start button. System is in vacuum mode. Vacuum light is on.

4. Vacuum cycle is 45 seconds followed by a buzzer and light. The spool handle must be switched to the "Raised" position. System is still in vacuum mode.

5. After 10 seconds the vacuum light will turn off and the pressure light will light. The system is then in the pressure mode.

6. Pressure cycle is 45 seconds followed by a buzzer and a light. The spool handle must then be switched to the "Lower" position. The system is still in the pressure mode.

7. When pressure builds up to 85 PSI, the pressure light will go out and the bleed light will go on. The system is then in the bleed mode.

8. After 10 seconds the bleed light will go out. Vacuum-fill process is completed.

9. Remove clamp from pump. Screw the fill plug into pump before either pumping or switching spool handle. The tilt system is bled and filled. It will take approximately 4 to 8 strokes to activate system.

10. In case of power failure, the system will reset to beginning of vacuum-fill cycle.

C. MAINTENANCE OF VACUUM-FILL STAND:

1. Approximately every 40 hours of use, the internal reservoir requires draining. A white light will light indicating this. If currently filling a truck, finish the bleed/fill process. When finished, press reservoir drain button and unit automatically empties reservoir and

C. MAINTENANCE OF VACUUM-FILL STAND CONT.

resets itself. The white light goes out. You may continue to fill tilt systems.

2. The vacuum pump jars must be inspected monthly and cleaned if needed. Care should be taken in unscrewing the jars.

D. TROUBLE-SHOOTING POWER-PACKER SYTEM: ON-LINE

1. If the "System Leak" light and buzzer activate, check all fittings for tightness.

2. Check system for crossed hoses.

E. MANUAL FILL PROCEDURE: ON-LINE

1. Remove 90 degree elbow from "Pull" port. Install tee and cylinder hose.

2. Remove 90 degree elbow from "Pull" (outside) port of L.H. tilt cylinder. Install tee and cylinder and shift disconnect hoses.

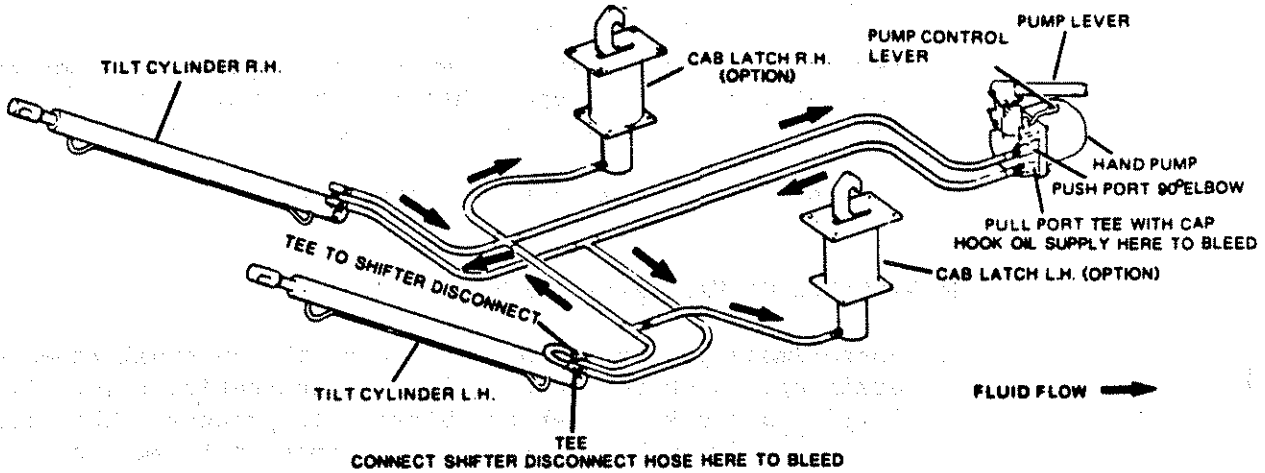
3. Selector value must be in "Lower" position.

4. Connect fill hose to tee in "Pull" port of pump.

5. Remove fill port plug.

6. Activate barrel pump to fill system. Fill until oil appears to fill port.

7. Plug fill port. Remove fill hose and cap tee.



REQUIRED CONNECTIONS TO BLEED SYSTEM

A. MANUAL BLEEDING AND FILLING PROCEDURE

1. Be sure all hydraulic lines are connected and the reservoir is full. Note that cylinders are shipped full of oil.

2. Loosen the four connections on the tilt cylinders and the shifter disconnect cylinder. Do not completely disconnect. Check that all other connections are tight.

3. Fill the pump reservoir to the top with the specified hydraulic fluid. Close and tighten the filler plug.

4. Place the selector valve in the CAB LOWER position. Operate the pump until all air is bled from the DOWN lines, then tighten the connections at the PULL ports on the tilt cylinders.

IMPORTANT: Step 4 MUST be made before Step 5. Do not reverse the sequence of this procedure.

5. Place the selector valve in the CAB RAISE position. Operate the pump until all air is first bled from the shifter disconnect line, then tighten that fitting. Continue pumping until the UP lines are free of air, then tighten the connections at the PUSH ports on the tilt cylinders.

6. After the whole system is bled, and all connections are tight, return the selector valve to CAB LOWER position. Check the fluid level in the pump reservoir and refill to the top. DO NOT REFILL THE RESERVOIR WITH THE CAB IN THE RAISED POSITION.

B. REMOVING EXCESS AIR FROM SYSTEM

1. To Remove Air from Pump Piston: (Spongy Feeling)

   a. With cab in travel position, place valve in "LOWER" position and loosen the pull port hose end fitting on pump.

   b. Pump until bubble-free oil appears at fitting, then tighten fitting.

   c. Bleed remainder of system if spongy feeling persists.

2. To Remove Air from Shifter Disconnect Cylinder:

   NOTE: Cylinders are shipped full of oil.

   a. Since cylinder is mounted at the hightest point in the system, air goes to the top and will not discharge to the reservoir.

b. Make sure disconnect cylinder is fully collapsed. Loosen fitting on cylinder. With control handle in "RAISE" position, actuate pump until bubble-free oil appears at fitting. Allow approximately 2 fl. oz. (¼ cup) fluid to flow out to insure that entire hose is free of air. A small, acceptable amount of air may remain in cylinder itself.

c. Tighten fitting and refill reservoir until oil appears in fill port. Replace and tighten fill port plug.

3. To Remove Air from Tilt Cylinder:

a. With cylinder in retracted position and cab down in travel position, loosen push port fittings slightly and place control handle in "RAISE" position. Actuate hand pump until bubble-free oil appears at cylinder ports. Tighten push port fittings at cylinders.

b. Loosen pull port fittings at cylinder and place control handle in "LOWER" position. Actuate pump slowly several times until bubble-free oil appears at loose pull fittings at cylinder.

c. Tighten fittings at cylinder. Refill pump reservoir with cab in down position until oil appears in fill port.

d. Tilt cab fully and return to down position. Refill reservoir if necessary.

C. TROUBLESHOOTING

NOTE: Air, dirt, and lack of oil account for 75% of all hydraulic problems.

1. Loosen fill plug. The Power-Packer system uses a sealed reservoir and under some situations, a vacuum lock can occur.

2. Check hoses for free flow. Blocked or kinked hoses can interfere with system operation.

3. Check for locked velocity fuses, which are flow sensitive check valves designed to lock up the cylinder in the case of a broken hose or fitting. They are sensitive to excessive air in the system and can lock up accidentally if the system is operated while improperly bled. They must be pumped off their seats by reversing the control handle and pumping. For example, if one locks up while the cab is being lowered, and there are no other problems with the system, move the control handle to "RAISE" and pump.

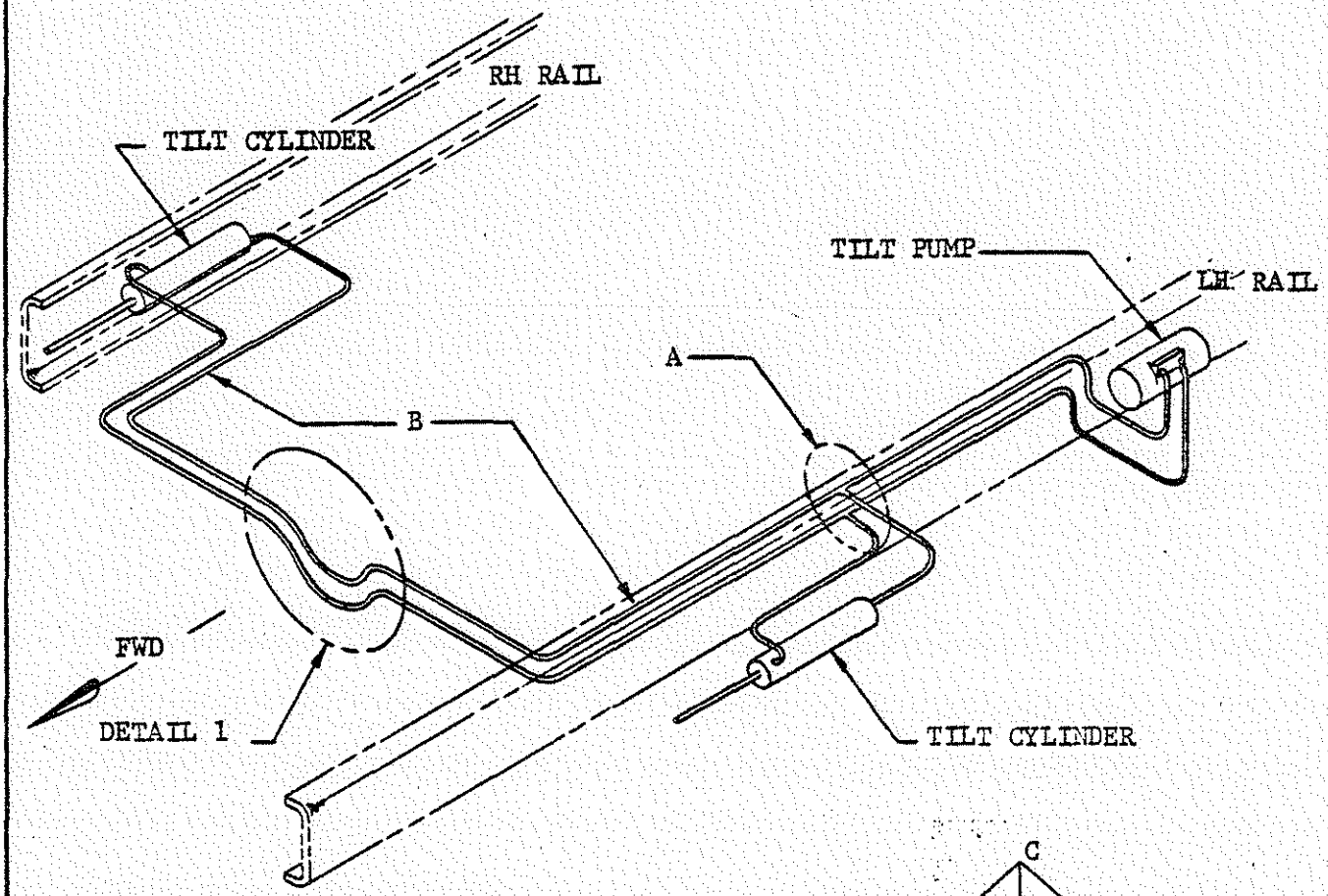
F/C Tilt Sqve

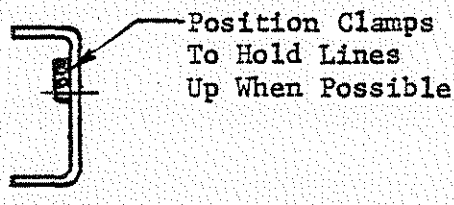
Compiled KAMERZELL	SHOP PRACTICE CAB TILT INSTALLATION		33-18120
Approved L.GILLESPIE			
Issued ~~10-13-69~~			
B Revised 1-27-75	Chg Ltr B	FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

A. PLUMBING, TILT CYLINDERS

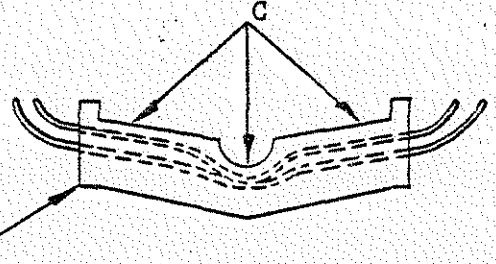
Plumb Hydraulic Lines from Tilt Pump under and to inside of LH frame rail and forward. At points "A" each line is tapped with a Male Branch Tee. Two lines are routed thru Anchor Couplings in the rail to the LH Tilt Cylinder. The remaining two lines continue forward, crossing over to the RH rail, passing behind the trunnion (as shown in detail 1), AFT along inside of the RH rail, then under the rail to the RH Tilt Cylinder. Attach Hydraulic Lines with hose clamps at points "B" (to the frame rail) and points "C" (to the Trunnion). The frame attachment should be made with clamps (REF PART No, 12-9068-0) positioned to hold the lines toward the upper flange for greater protection when possible. (See Detail 2)

A Use Hydraulic Fluid per Materials Specification 48-02207.





DETAIL 2



DETAIL 1

Form E-45

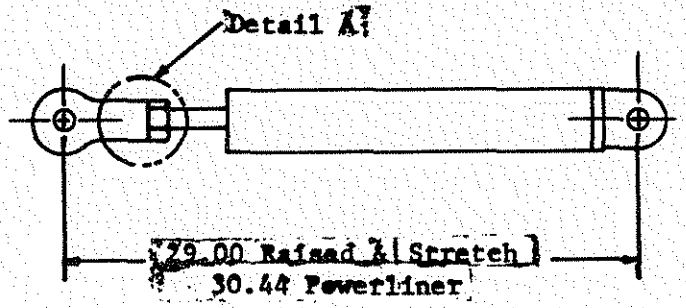
F/C tilt save

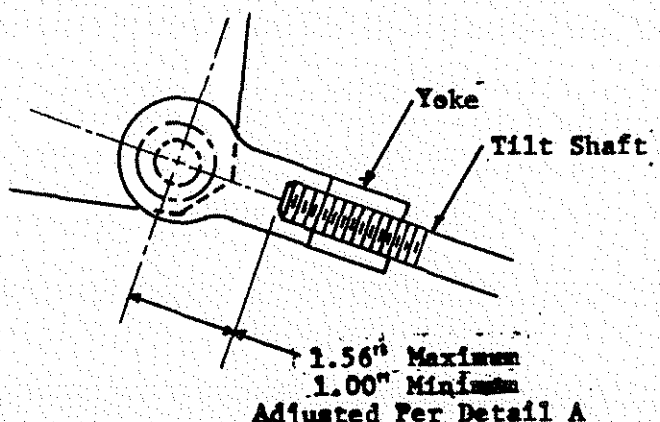
B. TILT PUMP ASSEMBLY

The assembly of the tilt pump reservoir tank (18- 2137) to the tilt pump body (18- 2165) must be made in such a manner that the air vent is in the vertical, 12 o'clock position. This position must be maintained to minimize hydraulic oil loss in service.

C. TILT RAM AND YOKE ADJUSTMENT

The yoke attaching the tilt ram to the front cab pivot must be adjusted to assure that the piston does not bottom out in the tilt cylinder when the cab is resting on the rear mounts. To avoid this problem, compressed tilt rod all the way in, adjust yoke eye center to 29.00 ± .03 from cylinder mounting hole center see illustration below and lock yoke in place.





REVISED & RETYPED "B" CHG

F/C Tilt Save

D. Filling the System

1. Open both vent and fill holes.
2. Fill reservoir with hydraulic fluid (48-0220z)
3. Open needle valve a turn then switch cyclomatic valve and close needle valve.
4. Pump tilt pump until tilt rams are completely extended maintaining the reservoir fluid level.
5. Open needle valve and switch cyclomatic valve, then close needle valve. Do not add any more hydraulic fluid.
6. Pump tilt pump and fully retract rams.
7. Top up reservoir if necessary until fluid level is at bottom of fill hole.
8. Close vent and fill holes.

Details on bleeding the tilt pump system are in Sec. 35-18100 of the Maintenance & Lubrication manual.

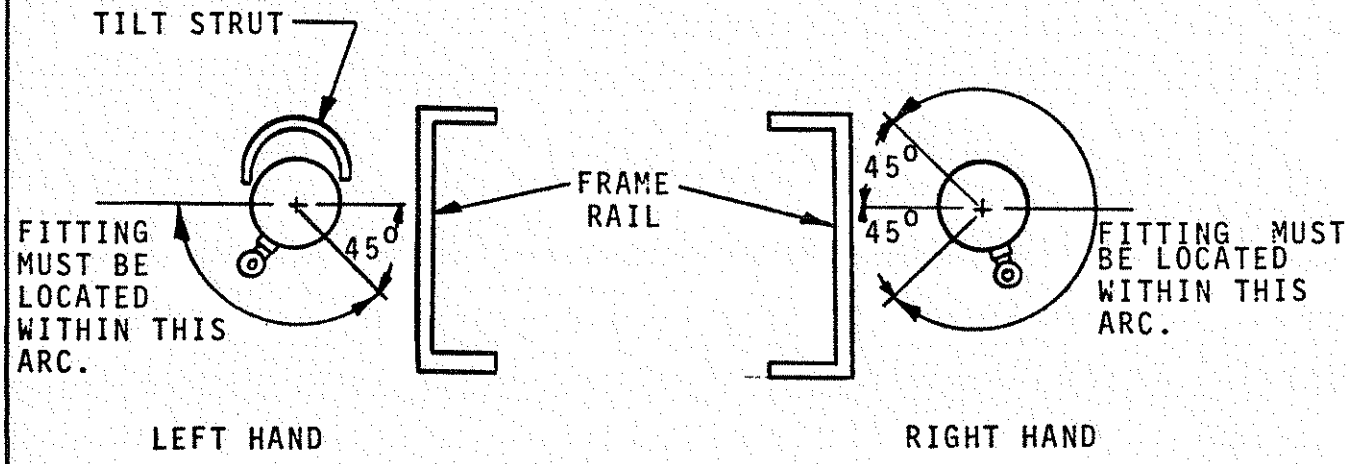
F/C Tilt Save

A

E. HYDRAULIC FITTING ORIENTATION

IT IS IMPORTANT THAT THE TILT CYLINDER END CAP FITTING BE ORIENTED ANYWHERE WITHIN THE ARCS SHOWN IN THE SKETCH BELOW. THIS IS A SAFETY PRECAUTION TO PREVENT THE FITTING FROM INTERFERING WITH EITHER THE TILT STRUT OR THE RADIATOR SUPPORT STRUT. THIS PRECAUTION WILL AVOID THE POSSIBILITY THAT UPON RAISING OR LOWERING THE CAB THE FITTING MIGHT BE SHEARED OFF. SUCH AN OCCURRENCE WOULD CAUSE A SUDDEN LOSS OF HYDRAULIC SYSTEM PRESSURE AND RESULT IN THE UNCONTROLLED FALL OF THE CAB.

TO MEET THIS CRITERIA, CYLINDER ASSEMBLIES MUST BE CHECKED PRIOR TO INSTALLATION ON THE CHASSIS FOR PROPER FITTING ORIENTATION. STATISTICALLY, 75% OF CYLINDER ASSEMBLIES CAN BE USED ON EITHER LH OR RH SIDES, THE REMAINING 25% COULD BE USED ON RH ONLY.



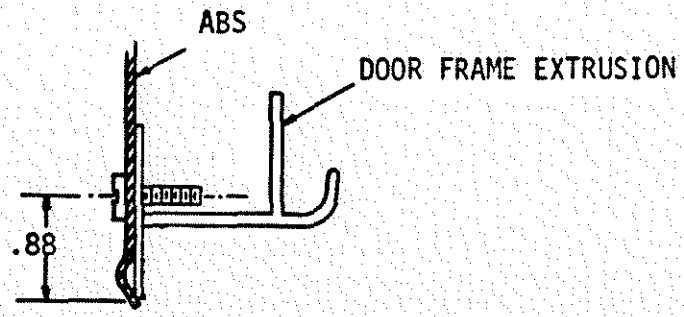
LEFT HAND

RIGHT HAND

Compiled	G.Hadley	SHOP PRACTICE HEADLINER INSTALLATION	33-18122
Approved	DRS		
Issued	4-10-74		
Revised	10/13/88	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-66

1. ABS HEADLINER

To avoid running the mounting screws into the door seal, the holes are to be drilled 0.88" up from the lower edge of the extrusion.



2. HEADLINER INSERT

Inserts are installed into ABS headliners using MEK cement and self tapping, black finish, Torx oval washer head screws.

Compiled	B. LAWYER	SHOP PRACTICE	
Approved		CAB MASK INSTALLATION, COE	33-18123
Issued	11-21-79		
Revised	8-16-83	Chg Ltr D FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

1. Windshield Plane

A flat windshield plane will provide a good chance to obtain a leak-free windshield. This, in part, is made possible by a one-piece tooled cab mask. However, an inaccurate positioning of any adjacent part such as windshield header beam, nose beam, door frame, etc. will inevitably cause distortion or out-of-plane of the mask and windshield glass.

To avoid the above problem, the following critical dimensions must be periodically checked:

1. @ B.L. 0.00, w/s mask is @ Sta. 7.381 & El. 53.250 (Fig. 1)
2. @ B.L. 0.00, mask is @ Sta. 2.430 & El. 31.312 (Fig. 2)
3. @ B.L. 45.070, mask is @ Sta. 11.721 & El. 53.250 (Fig. 3)
4. @ B.L. 45.070, mask is @ Sta. 6.770 & El. 31.312 (Fig. 4)
5. w/s plane makes 12° 43' w/vertical as measured parallel to cab C_L.
6. w/s plane (LH or RH) makes 5½° w/transverse plane of vertical plane @ B.L. 0.00.
7. Acceptable flatness tolerance dimensions are given in page 3.

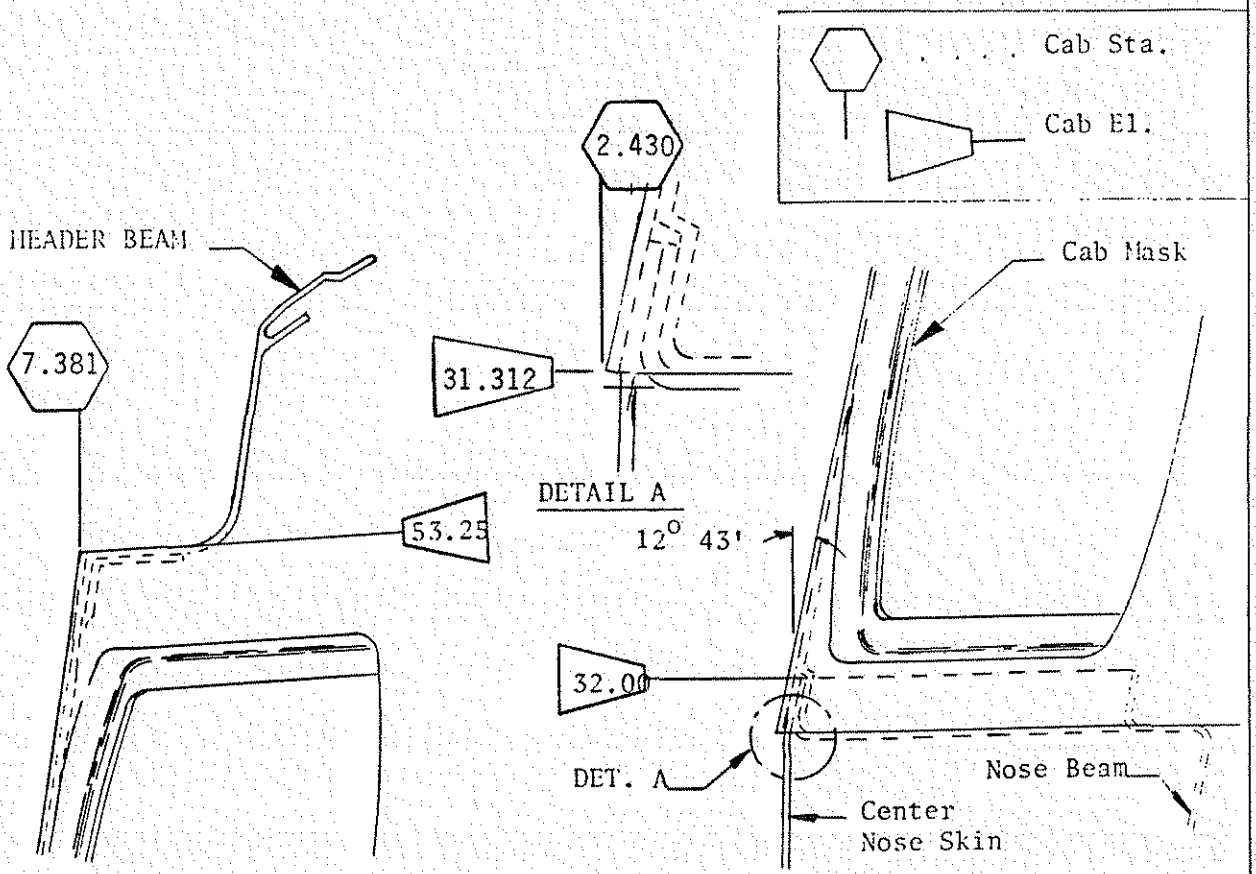


FIG. 1

FIG. 2

Compiled	B. LAWYER	SHOP PRACTICE CAB MASK INSTALLATION, COE	33-18123
Approved			
Issued	11-21-79		
Revised	10-1-82	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	PAGE 2

B A

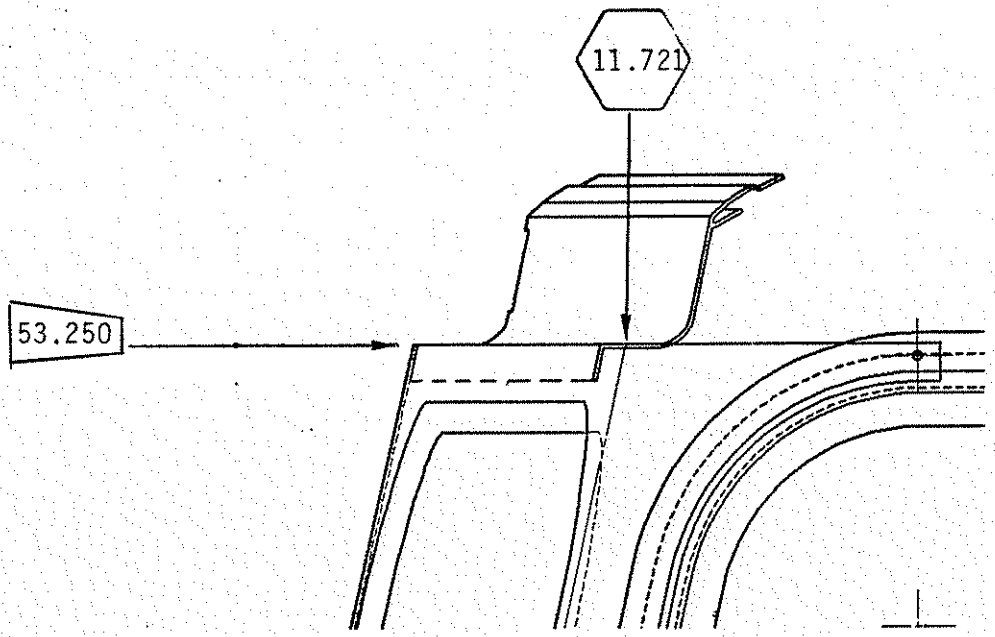


FIG. 3

B

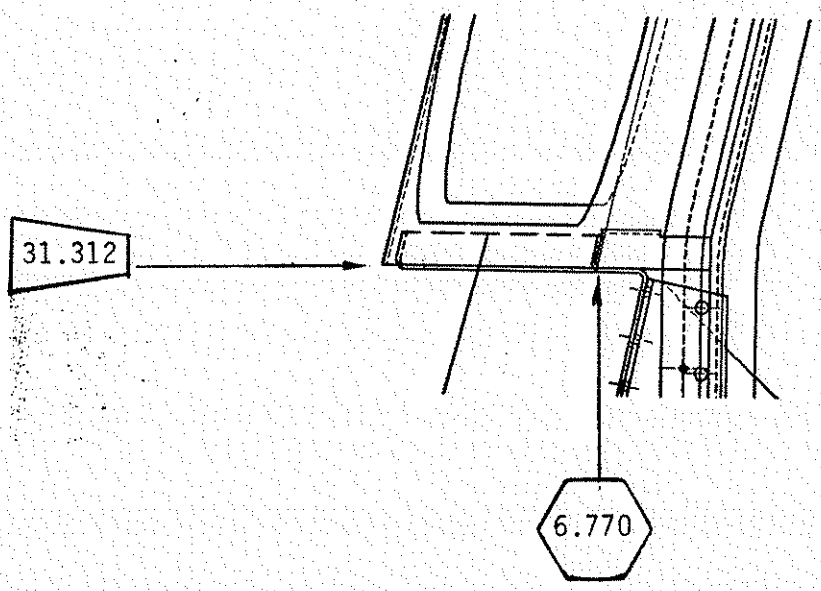
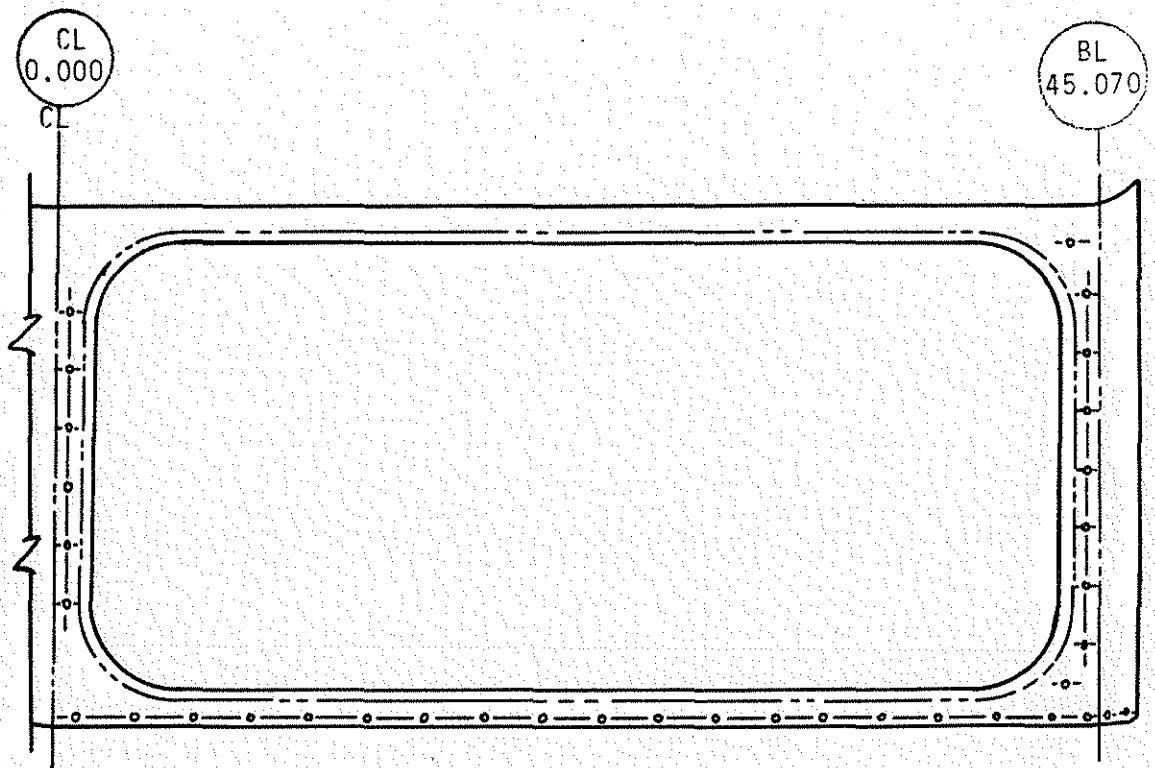


FIG. 4

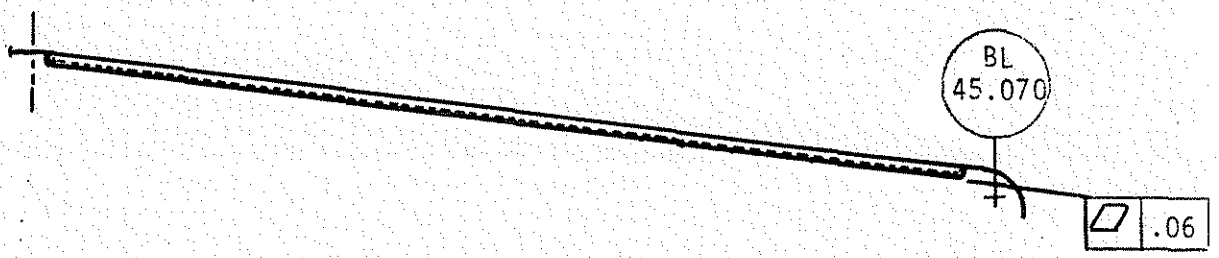
Compiled	B. LAWYER	SHOP PRACTICE CAB MASK INSTALLATION, COE	33-18123
Approved	[signature]		
Issued	11-21-79		
Revised	10-1-82 Chg Ltr C	FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 3

C

A



B



B

B

A

2. Offset on Cab Mask

The cab mask and the upper nose skin are both attached to the cab door frame and overlap each other. This creates a gap that is a potential source of water leaks.

If the cab mask does not already have an offset as shown in Fig. 5&6 . At the shops option, form this offset @ assembly. Suggested formed configuration is shown in Fig. 7.

Besides the foam tape used, the gap must be filled and plugged with caulking compound (48-118-001). Remove excess on the outside surface.

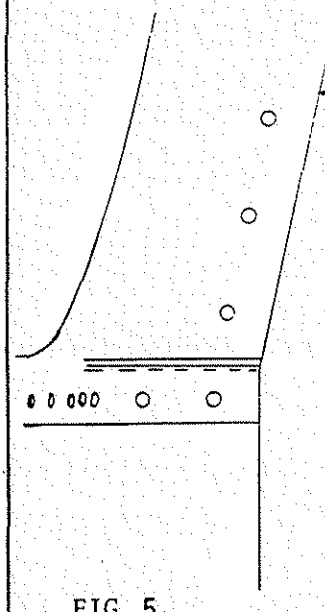


FIG. 5

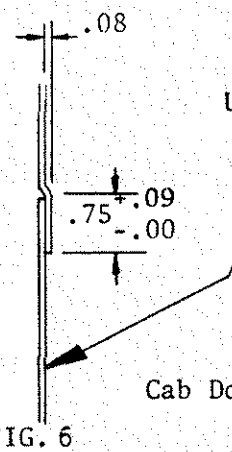


FIG. 6

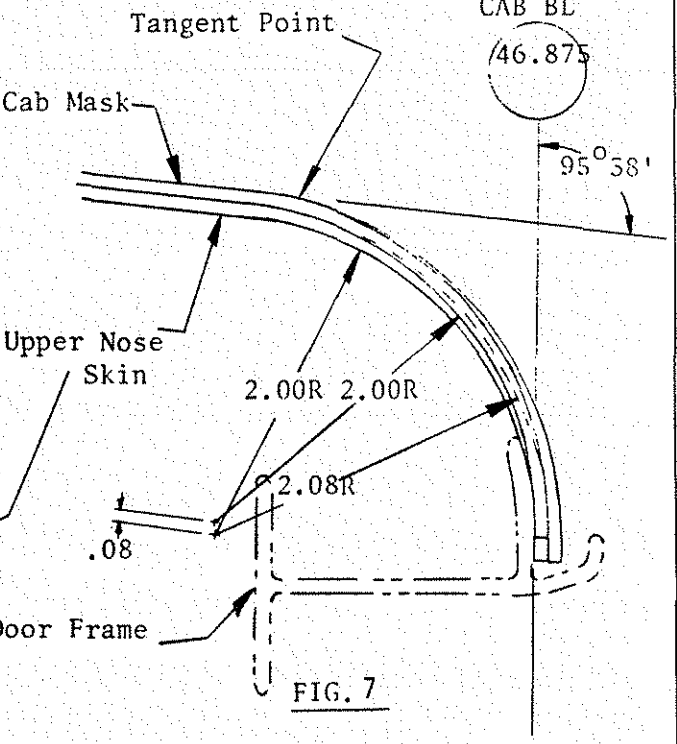


FIG. 7

NOTE: Stiffening flange on nose skin is not shown for clarity.

3. Exposed Gap @ Center Nose Skin Overlapping Upper Nose Skin

Offsets were provided at the upper nose skin and upper flange of the nose beam so that when the center nose skin overlaps the upper nose skin, it would result in a flat contacting surface with the mask. However, the offset @ upper nose skin was made a little wider to allow for tolerance built-up, thus creating an exposed gap (Fig. 8). In addition to foam tape, add a small amount of caulking compound to plug this gap (48-118-001). Remove excess on the outside surface.

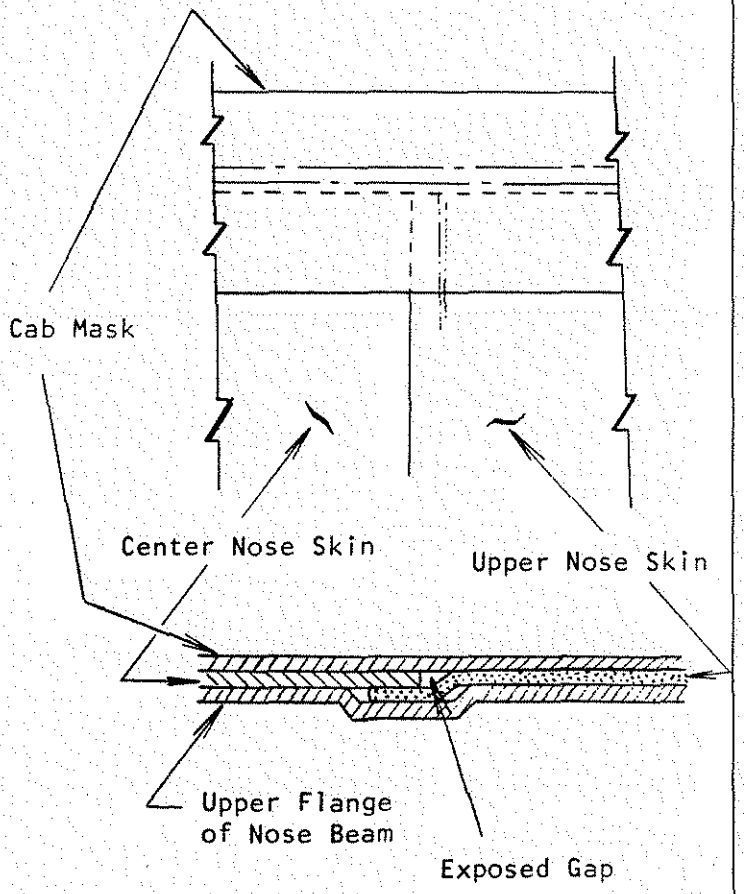


Fig. 8

Compiled	C. BLAKEWOOD	SHOP PRACTICE	
Approved		CAB MASK INSTALLATION	33-18124
Issued	6-9-84	CONV	
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

1. Windshield Plane

A flat windshield plane will provide a good chance to obtain a leak-free windshield. This, in part, is made possible by a one-piece tooled cab mask. However, an inaccurate positioning of any adjacent part such as windshield header beam, nose beam, door frame, etc. will inevitably cause distortion or out-of-plane of the mask and windshield glass.

To avoid the above problem, the following critical dimensions must be periodically checked:

1. @ B.L. 0.00, w/s mask is @ Sta. 8.376 & El. 53.250 (Fig. 1)
2. @ B.L. 0.00, mask is @ Sta. 3.323 & El. 31.312 (Fig. 2)
3. @ B.L. 34.700, mask is @ Sta. 11.899 & El. 53.250 (Fig. 3)
4. @ B.L. 34.700, mask is @ Sta. 6.846 & El. 31.312 (Fig. 4)
5. w/s plane makes 12° 58' w/vertical as measured parallel to cab $\mathcal{L}$.
6. w/s plane (LH or RH) makes 5½° w/transverse plane of vertical plane @ B.L. 0.00.
7. Acceptable flatness tolerance dimensions are given in page 3.

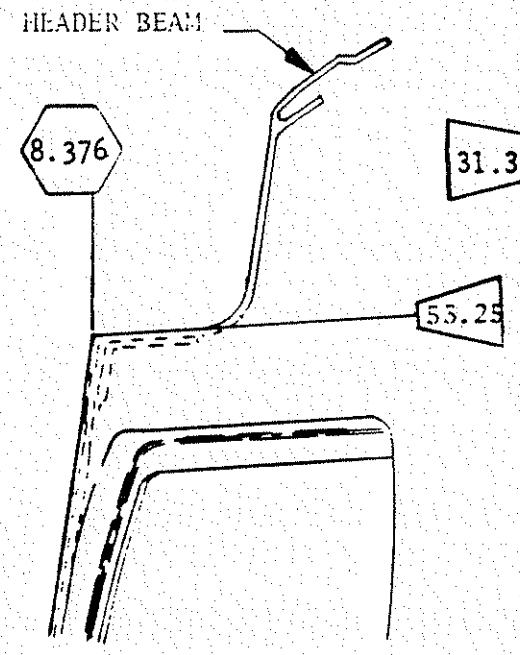


FIG. 1

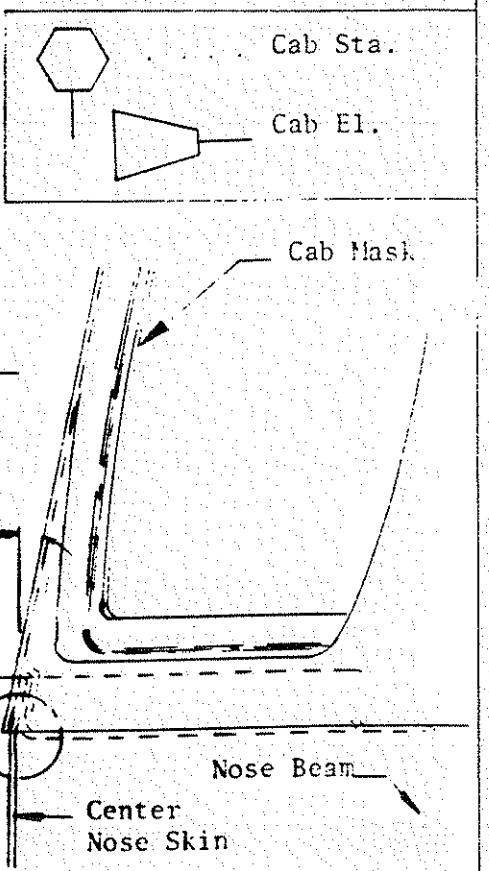


FIG. 2

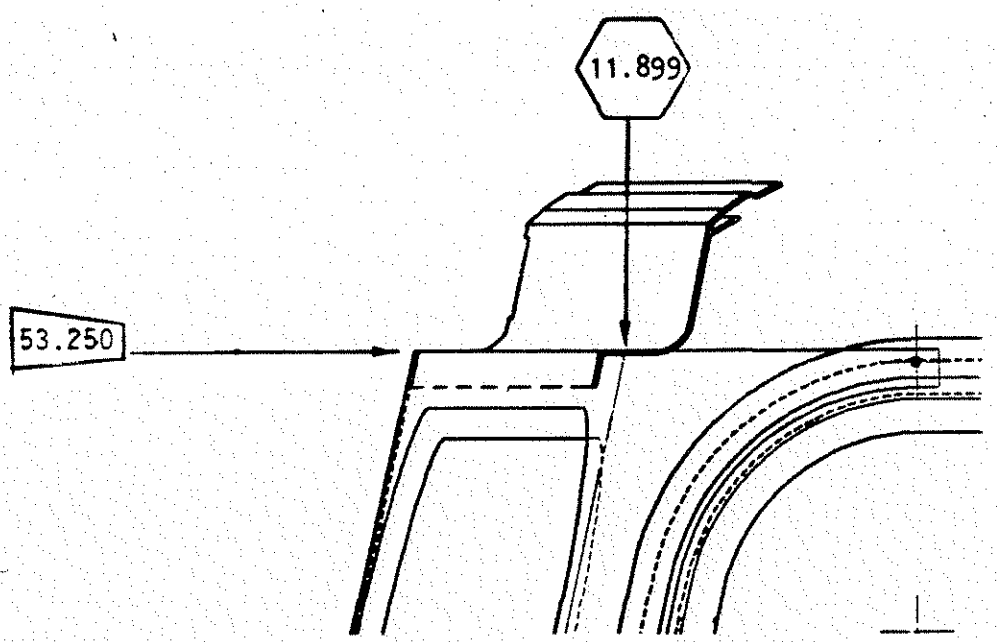


FIG. 3

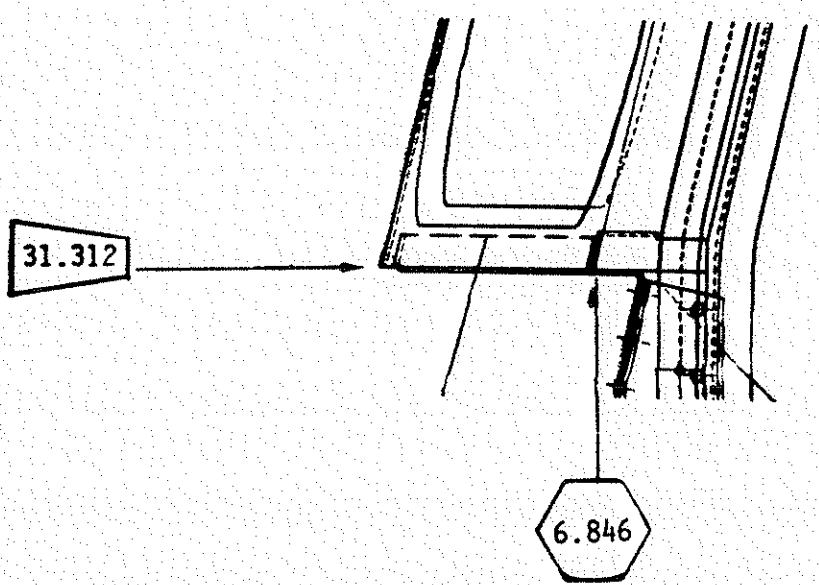
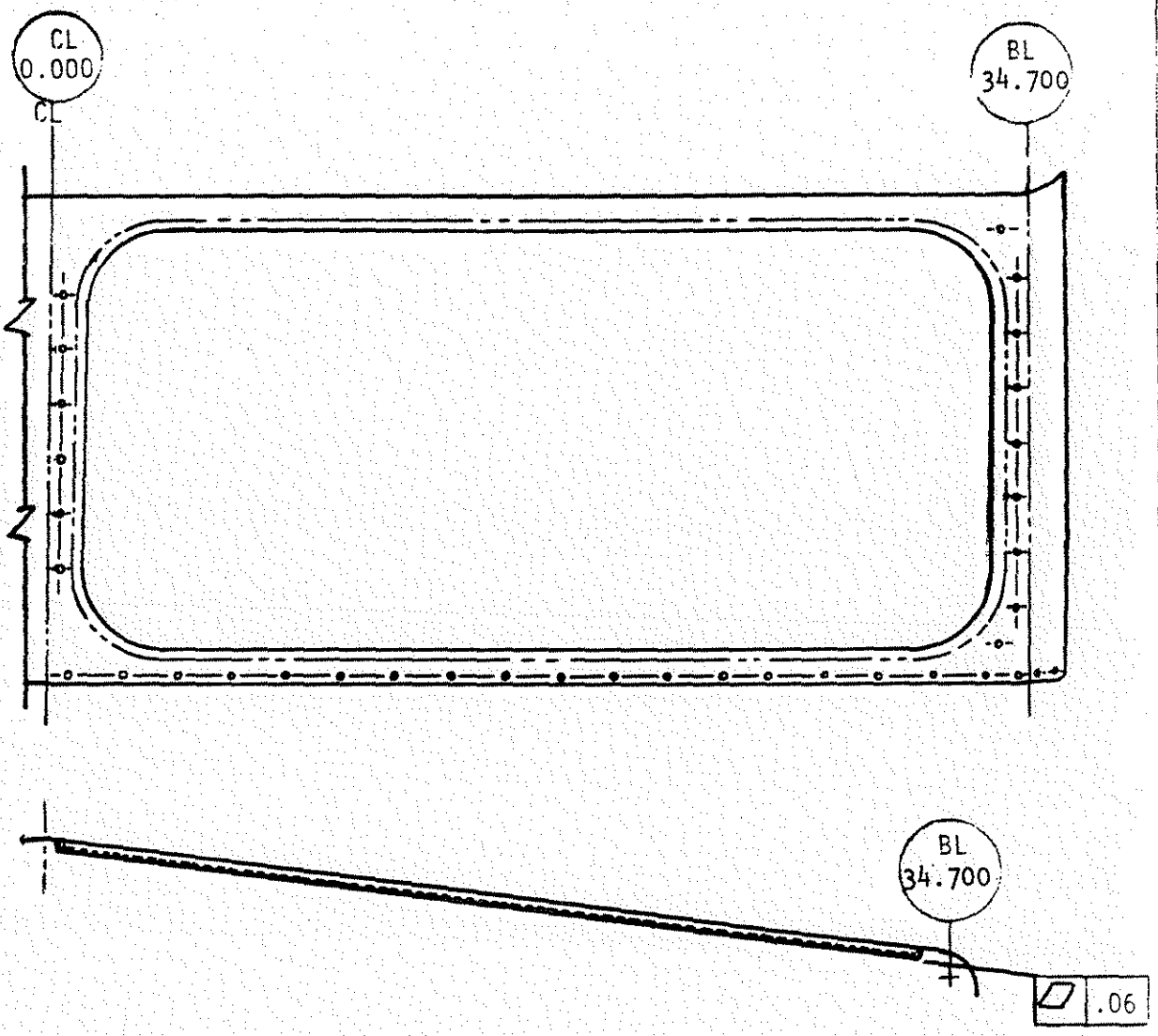


FIG. 4

Compiled	C. BLAKEWOOD	SHOP PRACTICE CAB MASK INSTALLATION CONV	33-38124
Approved			
Issued	6-9-84		
Revised		Chg Ltr	Page 3

FREIGHTLINER CORPORATION
PORTLAND, OREGON



2. Offset on Cab Mask

The cab mask and the upper nose skin are both attached to the cab door frame and overlap each other. This creates a gap that is a potential source of water leaks.

Besides the foam tape used, the gap must be filled and plugged with caulking compound (48-118-001). Remove excess on the outside surface.

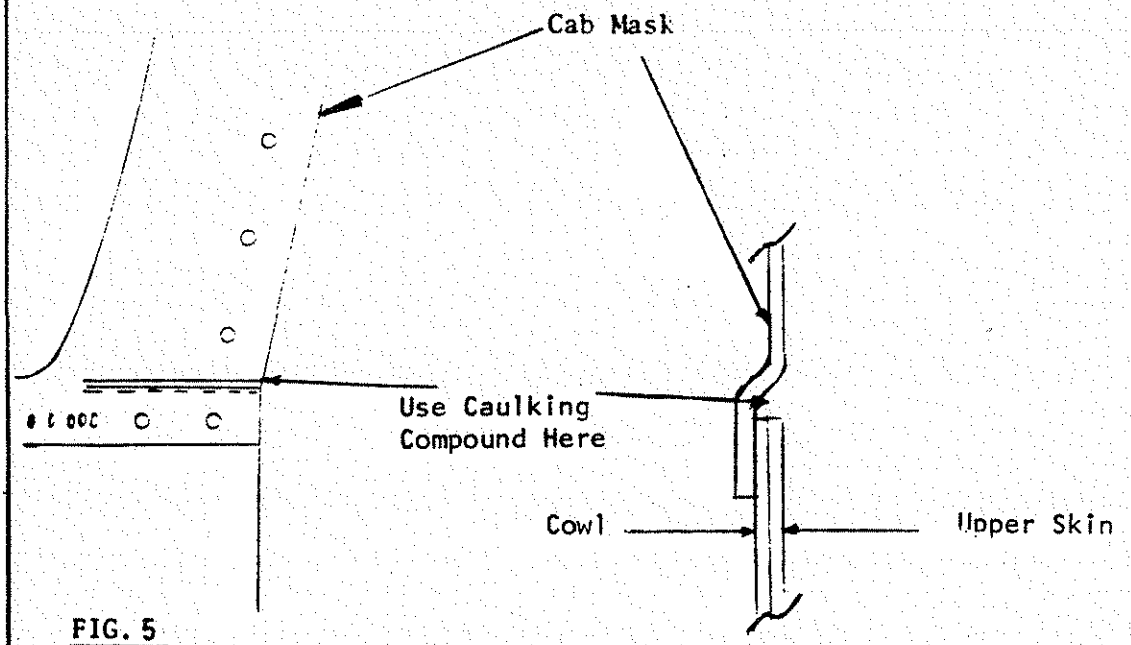


FIG. 5

Compiled	B. Lawyer	SHOP PRACTICE	33-18125
Approved	BK	CAB DOOR OUTER PANEL INSTALLATION	
Issued	11-21-79	FREIGHTLINER CORPORATION PORTLAND, OREGON	1
Revised	2-6-81	Chg Ltr A	

CAB DOOR OUTER PANEL INSTALLATION PROCEDURE:

1.) Apply activator to a strip 1.50 to 1.75 wide around the perimeter on the inside surface of the outer door panel (see Figure 1). Wipe off excess leaving a light film of activator on the surface. Allow activator to air dry for one - three minutes. The drying time may be shortened if a fan is used to increase air movement across the area.

CAUTION: Activator should only be applied in a well ventilated area.

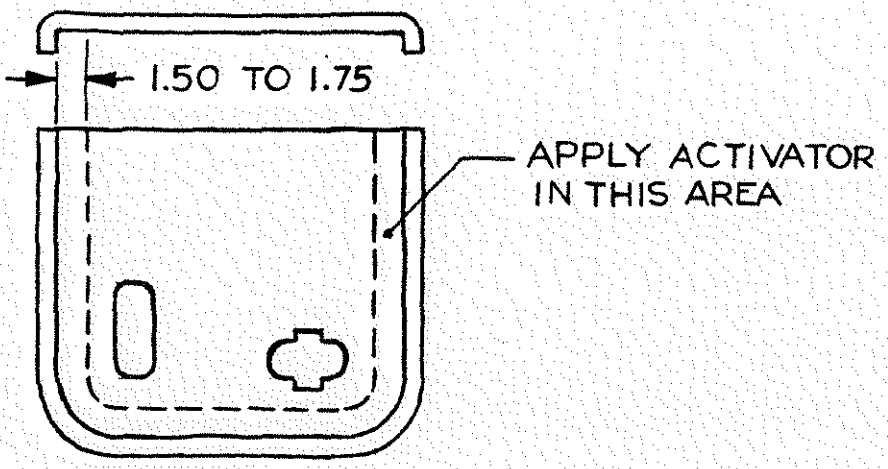


FIGURE 1

A 2.) The door frame should also have activator applied to the mating flange surface using the same technique mentioned above, (see Figure 2).

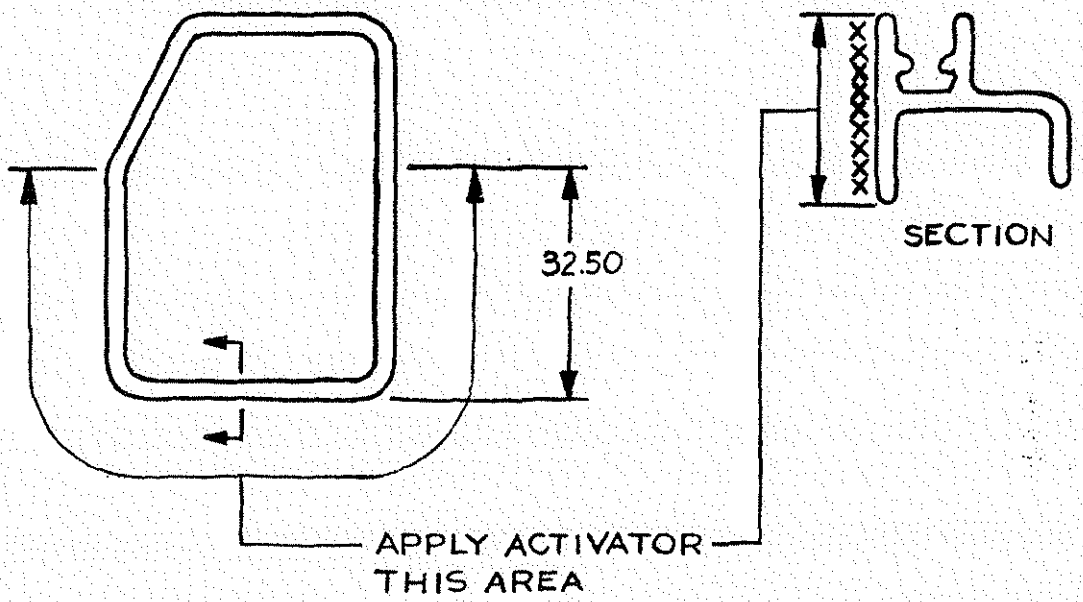


FIGURE 2

3.) With the applicator, apply a 3/16 diameter bead of structural adhesive about .50 away from the flange on the outer panel (see Figure 3).

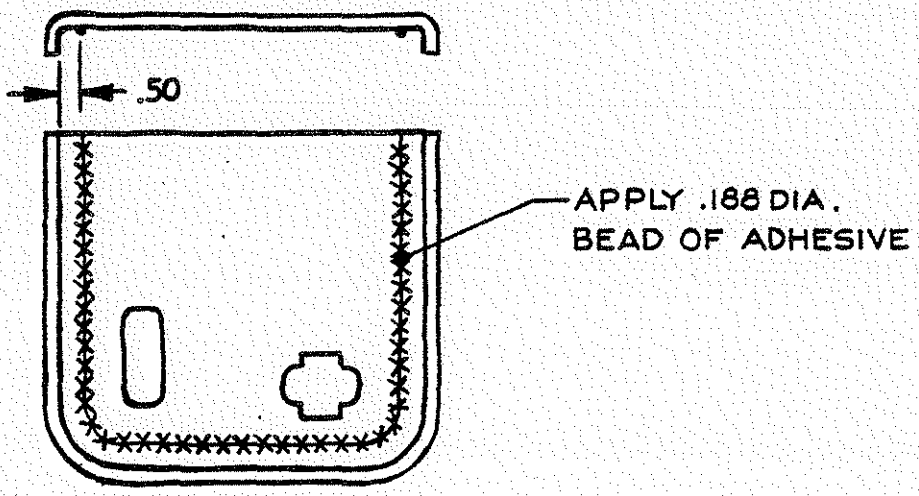


FIGURE 3

A

4.) With outer panel installed in the hemming machine, lay the frame into position and install a frame support strut. Crimp flange over to capture door frame, within one minute of adhesive application.

5.) Tack weld the outer panel to the door frame on the inside of the frame's outer flange (see Figure 4). Remove frame support strut.

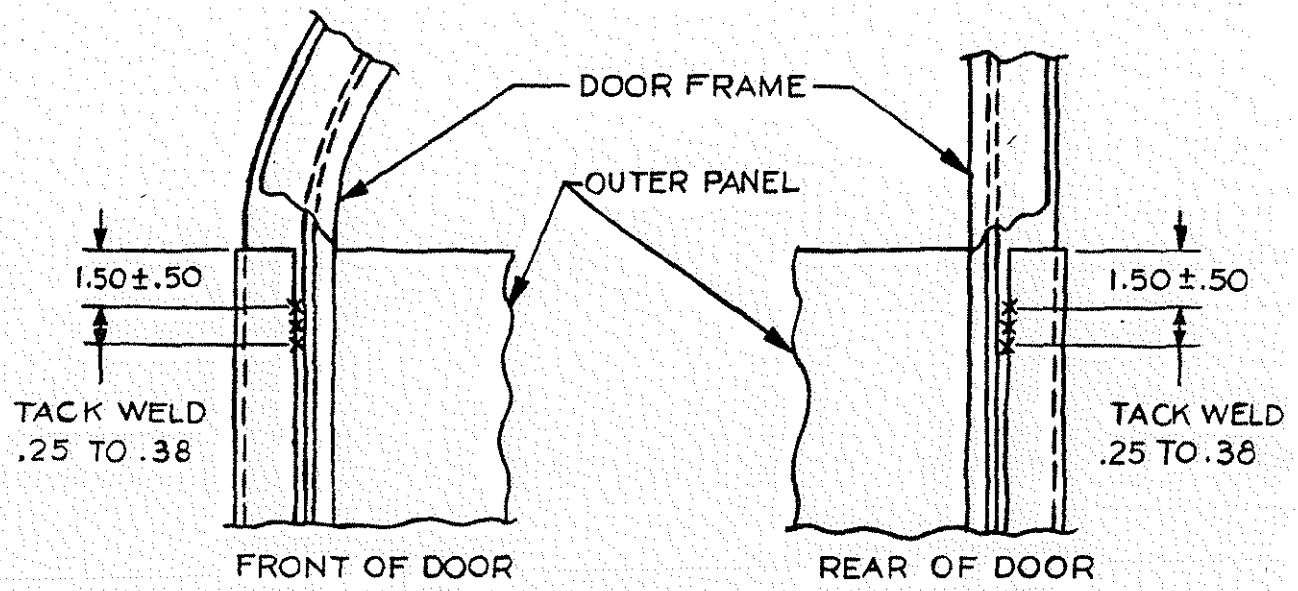


FIGURE 4

NOTE: The part temperature should be maintained above 65°F at the time of bonding to achieve an acceptable bond strength.

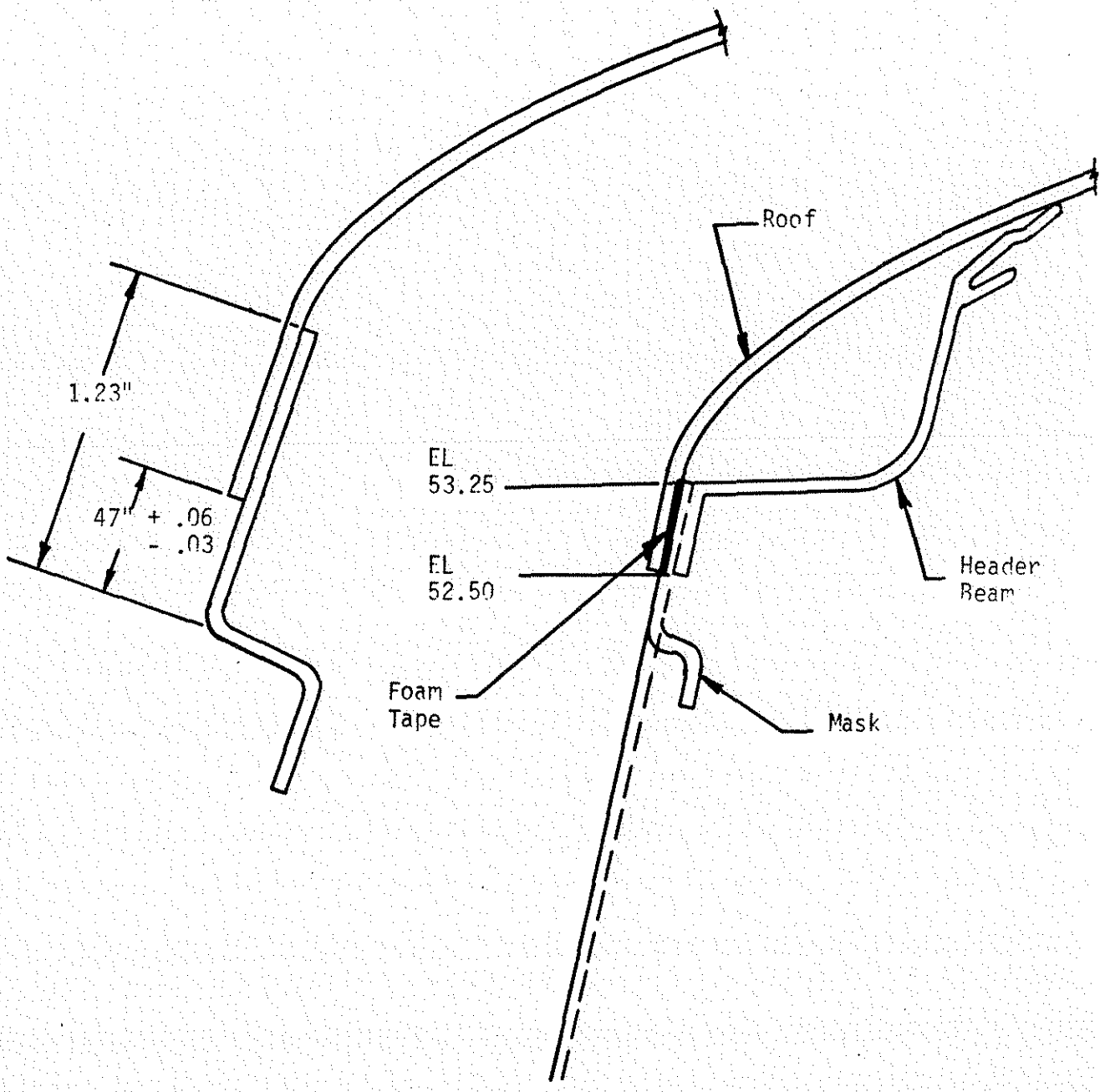
MATERIALS:

Structural Adhesive	48-02296-101
Activator	48-02296-202

Compiled	H. Dano	SHOP PRACTICE ROOF SKIN INSTALLATION COE & CONVENTIONAL	33-18126
Approved	DRS		
Issued	11-21-79		
Revised	6-9-84	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	

A

When the roof assembly is installed on the cab, the front edge of the roof must be positioned by a gauging fixture. Dimensions are shown below:

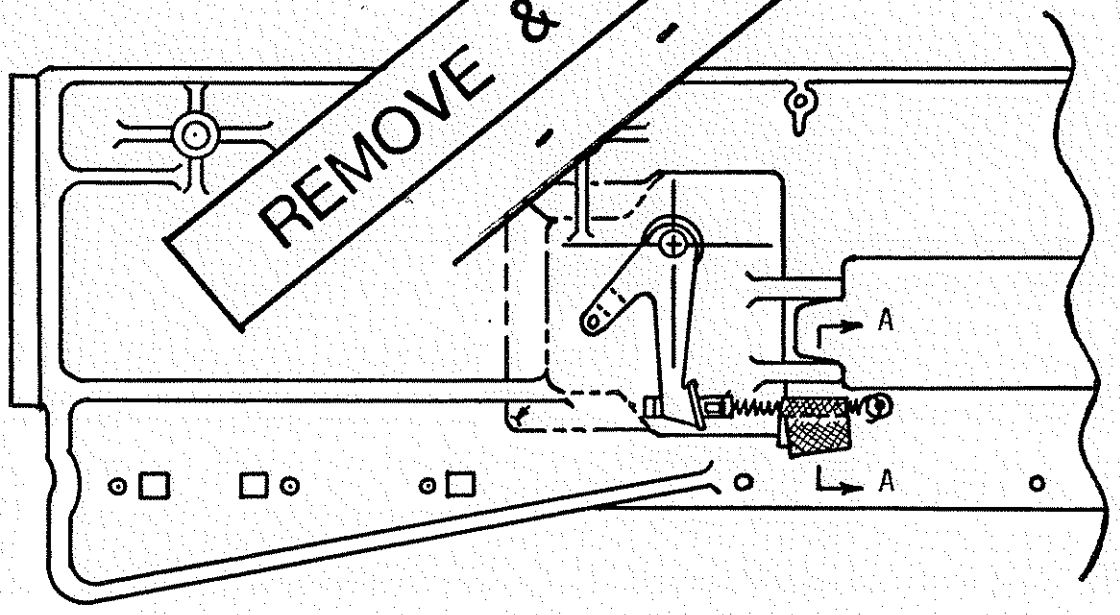


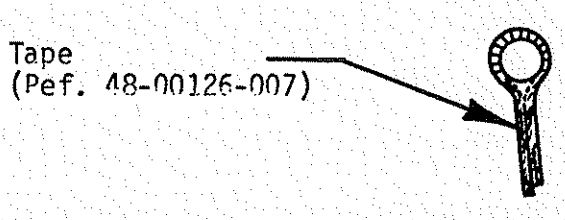
Compiled	G. KRANICK	SHOP PRACTICE WINDOWSILL ASSEMBLY	33-18127
Approved	B Koepke		
Issued	11-21-79		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-28

ADDITION OF TAPE TO PADDLE HANDLE RETURN SPRING

When the paddle handle and return spring are i... the sill, a piece of tape (48-00126-007) must be wrapped about mi... the return spring. The tape is necessary to dampen noise and vib... paddle handle and return spring.

REMOVE & DESTROY





Section A-A

COMPILED	S PAYNE	SHOP PRACTICE	SECTION NUMBER
APPRV	F H F	STAMPING, SERIAL NUMBER CAB	33-18128
ISSUE DATE	09/04/87		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-014 FOR STAMPING, SERIAL NUMBER CAB PROCEDURES.

Compiled	S. Payne	SHOP PRACTICE SERIAL NUMBER STAMPING	33-18128
Approved	F+F		
Issued	5-4-87		
Revised		Chg Ltr **FREIGHTLINER CORPORATION** PORTLAND, OREGON	

Cab Stamping Procedure

As a production option cabs or sleeper boxes may be stamped with the 6 digit vehicle serial number following these procedures.

A. LOCATION

1. COE: Locate serial number vertically on the left noseskin, above the upper cab pivot.

2. 120 Conventional: Locate serial number on the upper portion of the cowl reinforcement, passenger side.

3. Sleeper Boxes: Locate serial number on the left hand sleeper box mount.

4. 112 Conventional: RH firewall under air intake duct.

B. PROCEDURE FOR MAKING CORRECTIONS

1. Stamp over the wrong digit, do not grind.

2. Stamp the correct digit above or below the incorrect one.

3. Put the special correction stamp at both ends of the serial number.

4. Example:

[F] 123 4 56 [F]
4

5. If 3 or more digits are wrong, stamp over the whole serial number. Restamp the correct serial number nearby and use the correction stamp at both ends.

COMPILED	DEYO	SHOP PRACTICE CAB DOOR INSULATION	SECTION NUMBER 33-18130
APPRV	DEYO		
ISSUE DATE	07/30/80		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-015 FOR CAB DOOR INSULATION PROCEDURE.

Compiled	DEYO	SHOP PRACTICE CAB DOOR INSULATION	33-18130
Approved	[illegible]		
Issued	7-30-80		
Revised		Chg Ltr	

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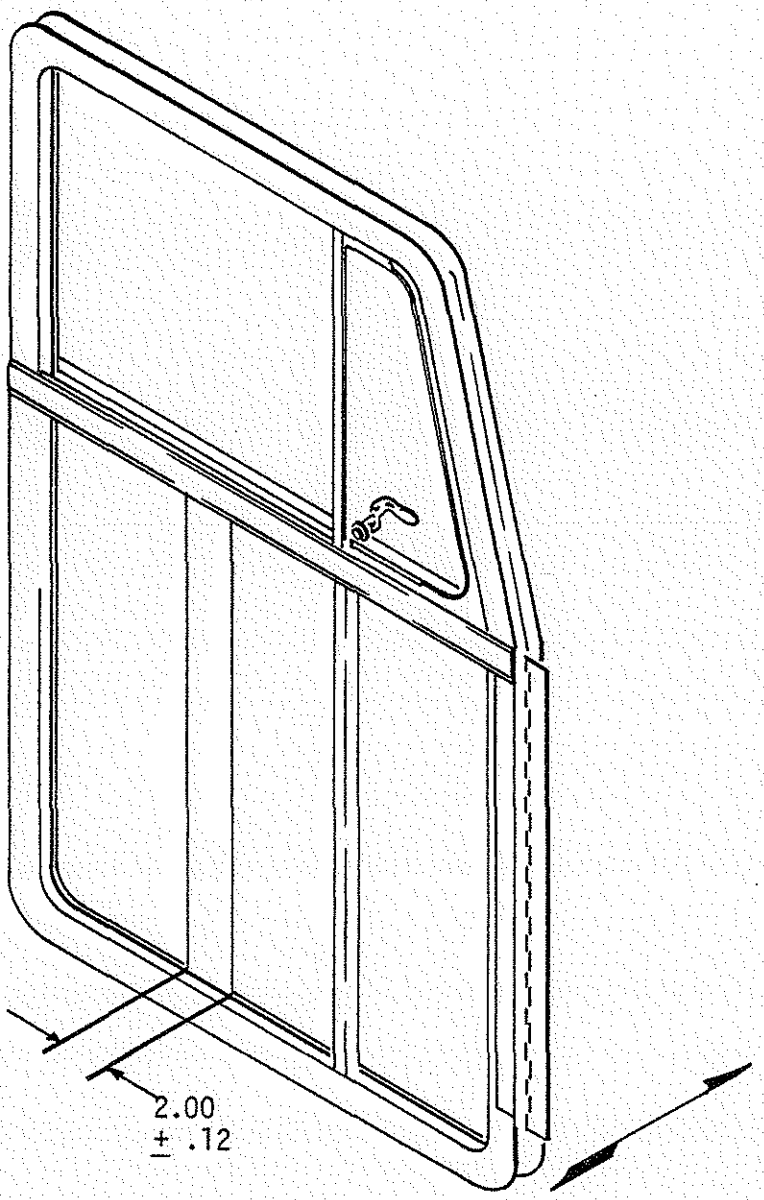
PORTLAND, OREGON

The door insulation, if specified, is to be installed with a roller as shown, directly over the undercoating. The perimeter of the pads require additional pressure against the roller to insure proper adhesion.

Air lift window, if present, the large insulation pad must be modified by removing a 2.00" wide strip (as shown) for actuator clearance.



COMPILED	M PRANGER	SHOP PRACTICE	SECTION NUMBER
APPRV	B K	INTERIOR SUNVISOR	33-18131
ISSUE DATE	02/18/83		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72
CHG LTR	A		

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0018-016 FOR INTERIOR SUNVISOR PROCEDURE.

Compiled	M. PRANGER	SHOP PRACTICE INTERIOR SUNVISOR	33-18131
Approved	C Knapke		
Issued	2-18-83		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

VISOR ASSEMBLY

To prevent binding on the pivot arm during assembly the pivot arm must be lubricated before insertion into the steel sleeve. Lubricate the tip of the arm for approximately 1.50" with Johnson's wax plate 15 wax or equivalant.

Compiled	BLAKEWOOD	SHOP PRACTICE CAB MOUNT INSTALLATION CONVENTIONAL	33-18301
Approved	G. Hadley		
Issued	2-22-74	Chg Ltr F FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised	1-27-82		

A. Front Cab Mount Installation

It is important that the front cab mounts be properly attached to the cab. The correct hardware must be used and assembled properly. The procedure is as follows:

1. Insert the 1/2" diameter bolt from the top of the isolater in order to position the nut on the bottom side of the frame rail flange.

2. [illegible]

3. SIDE FLANGE

   A. The side flange is attached to t[illegible] deck structure with (5) each) 3/8" - 24 UNF grade [illegible] class C prevailing torque lock nuts, and 5 lockbolt [illegible]

   B. Torque to 38 ± 5 ft. l[illegible]

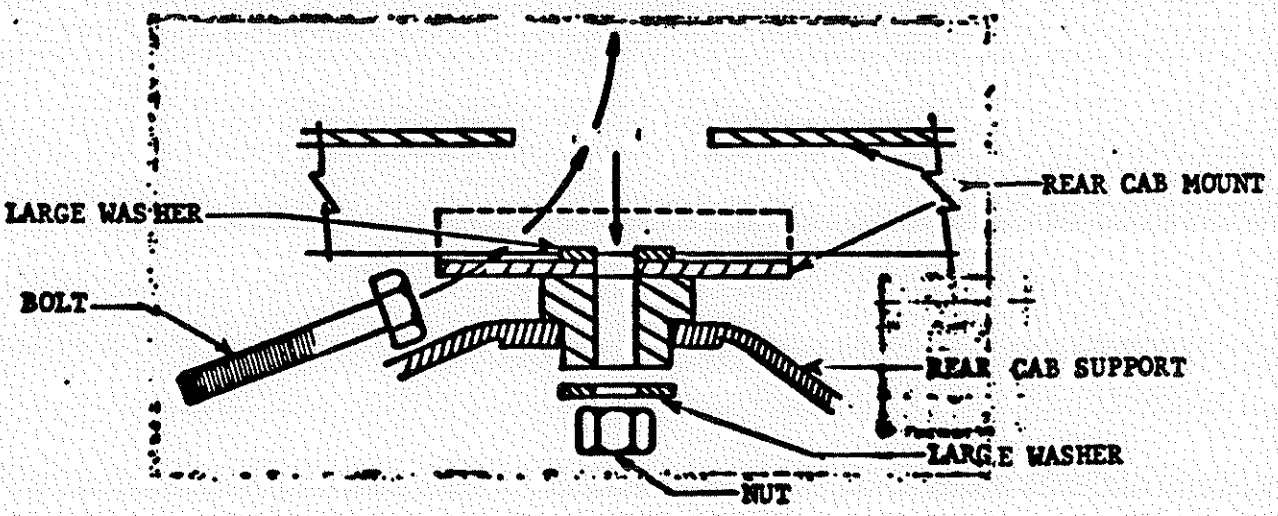
   C. The fasteners are [illegible] the heads inside the cab.

   D. Hardened [illegible] be used under the bolt heads.

REMOVE & DESTROY

B. Rear Cab Moun[illegible]

For even g[illegible]lity, the bolt should be dropped through the top of the cab mou[illegible] should not be pushed up from the bottom, through the cab support. [illegible] nut should be at the bottom.



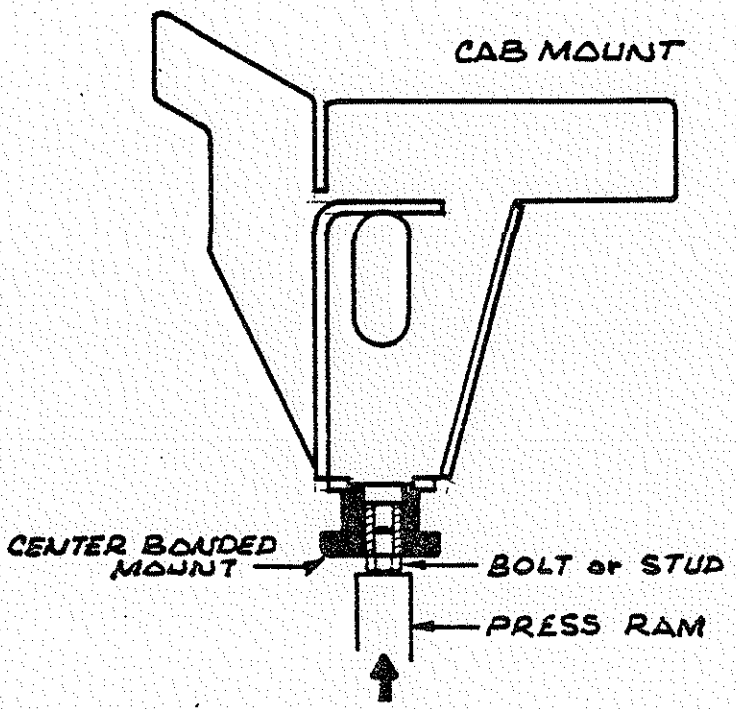
Compiled	MCLUCAS	SHOP PRACTICE TORQUING OF FRONT & REAR CAB MOUNTING BOLTS CONVENTIONAL	33-18302
Approved	T.LIETHEN		
Issued	4-8-74		
Revised	1-30-76	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

CONVENTIONAL CAB MOUNTING CUSHIONS ARE TO BE INSTALLED IN ACCORDANCE WITH THE FOLLOWING PROCEDURE:

1. Lubricate mounting cushion and socket with rubber lubricant or water. Do NOT use grease of any type!

2. Insert assembly fixture or driving bolt thru center tube. Driving member must not overhang steel tube, or damage will result to the rubber.

3. Apply sufficient force on the press ram to seat the mounting cushion shoulder tightly against supporting member.



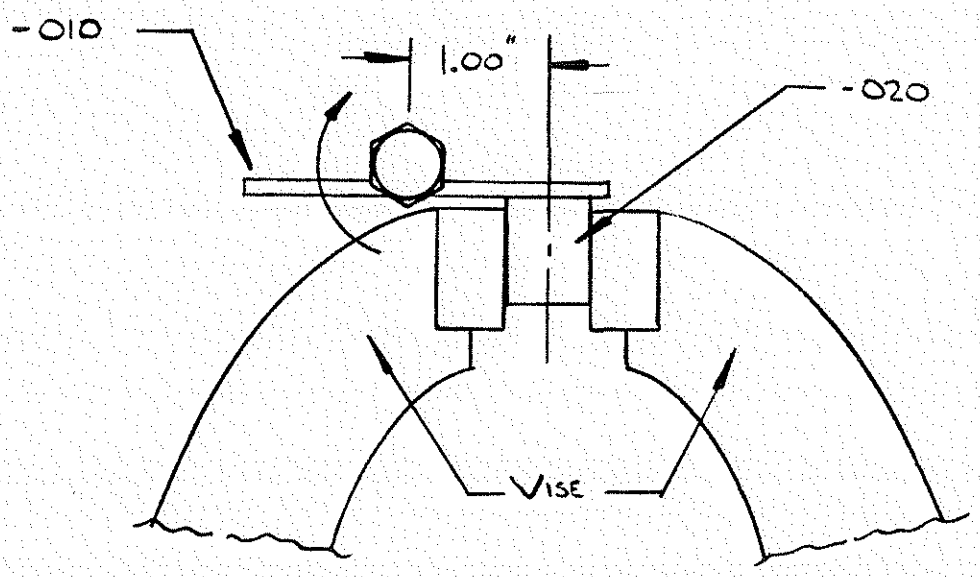
REVISED & RETYPED "B" CHG

Compiled	J. ADAMS	SHOP PRACTICE DOOR STRIKER TEST	33-18303
Approved	J Abernen		
Issued	6-16-83		
Revised		Chg Ltr **FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 1

This document is intended to be a guide for the operation in setting up his welder to insure consistent weld joints.

The A22-25302 baggage door striker assembly consists of a -010 plate and a -020 striker. The weld joint is tested as follows:

1. Assemble -020 striker to a flat -010 plate a shown on the print.
2. Weld a 2" X 5/16" NC capscrew to the -010 plate as shown below.
3. Clamp the -020 portion of the assembly in a vise as shown below.
4. Apply a torque wrench to the capscrew and apply 200 in-lbs of torque. The weld joint between the -010 and -020 must not fail. If it does fail, the welding equipment must be adjusted until 5 parts in a row are tested without failure. Only then may the production run continue.
5. During the production run, this test must be performed after every 50 parts to insure the quality of the weld joints. If a failure occurs, the previous 50 assemblies are subject to failure and must be scrapped.
6. The machine operation and his supervisor have the responsibility to carry out this test and the test reports are to be given to the QA department at the conclusion of the production run.



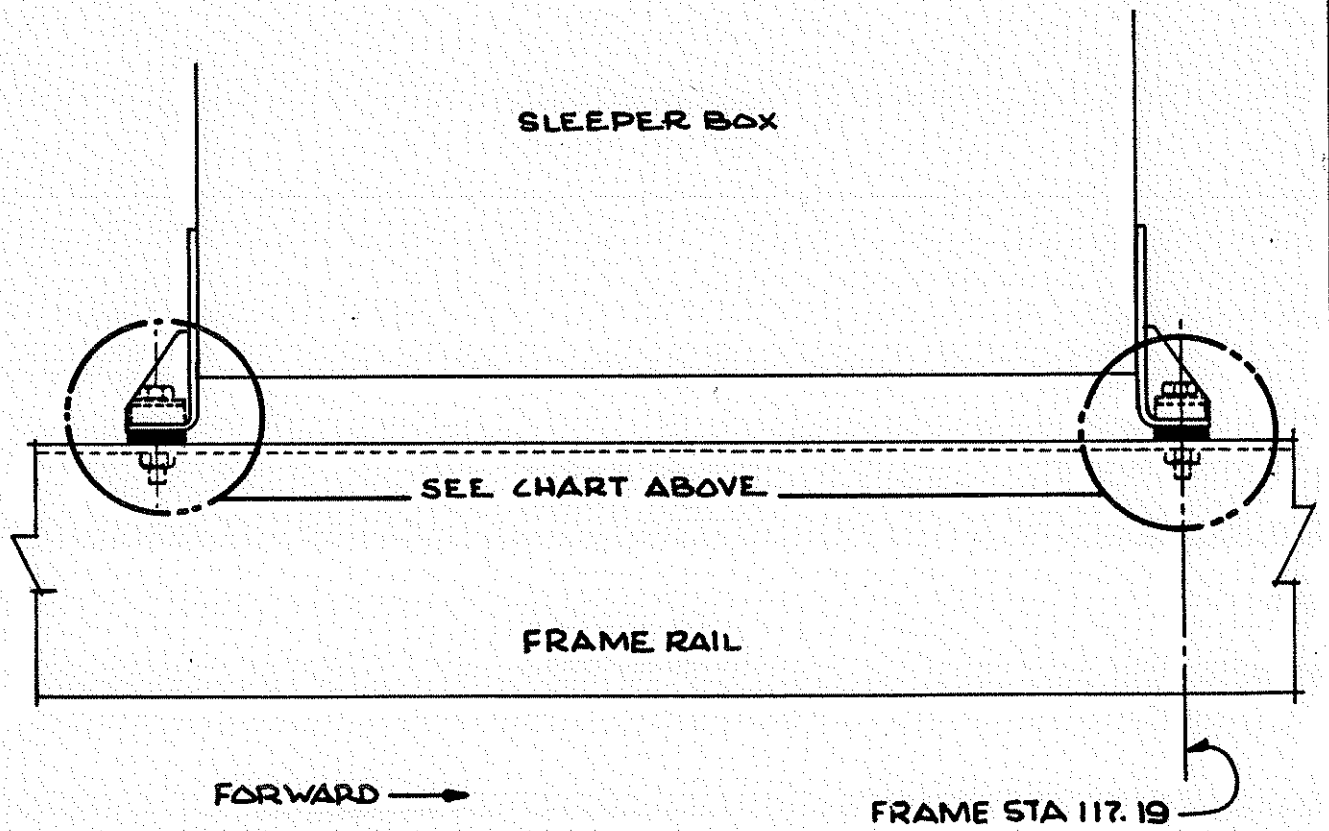
Compiled	B.SMITH	SHOP PRACTICE TORQUING OF SLEEPER BOX MOUNTING BOLTS CONVENTIONAL	33-18305
Approved	NLK		
Issued	3-29-76		
Revised	6-16-83	Chg ltr. B	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

TORQUE MOUNTING BOLTS FOR SLEEPER BOX AS FOLLOWS:

B

FASTENER	THREAD SIZE	GRADE BOLT MAT'L	TORQUE FT.-LB.	REMARKS
SLEEPER BOX MOUNT	1/2-20UNF	8	100 ± 10	Use grade C prevailing torque locknuts. Bolts & nuts are called out in parts book.



RH SIDE SHOWN.

Compiled	HJR	SHOP PRACTICE	33-21100
Approved		BUMPER, CONTENTS	
Issued	04/07/65		
Revised	07/21/88	Chg Ltr E FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-38

PRACTICE NO.	DESCRIPTION
33-21101	BUMPER PAINT REQUIREMENTS
33-21109	TORQUING OF SCREW FASTENERS

COMPILED	F F
APPRV	D C R
ISSUE DATE	05/21/76
REV DATE	07/29/96
CHG LTR	E

SHOP PRACTICE

BUMPER PAINT REQUIREMENTS

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-21101

PAGE
1 OF 1

PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0021-001 FOR BUMPER PAINT REQUIREMENTS.

Compiled	F.Freer	SHOP PRACTICE BUMPER PAINT REQUIREMENTS	33-21101
Approved	D.C.R.		
Issued	5-21-76		
Revised	11-6 87	Chg Ltr D	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

A. PAINTED BUMPERS

Paint the tow pin housing interior the appropriate bumper color (s).

B. CHROME OR POLISHED BUMPERS

Paint the tow pin housing interior with chassis color paint.

C. UNPAINTED ALUMINUM BUMPERS:

Wash with a solution of Oakite #33 or equivalent after chassis paint, to provide a bright finish.

D

D. PAINTED ALUMINUM BUMPERS:

Clean, conversion coat, (chrome phosphate process) and prime as per cab paint procedures. Finish paint as per vehicle paint chart instructions.

Compiled	F. FREED	SHOP PRACTICE TORQUING OF SCREW FASTENERS	33-21109
Approved			
Issued	12-15-65		
Revised	3-1-85 Chg Ltr D	FREIGHTLINER CORPORATION PORTLAND, OREGON	

GENERAL VALUES: See 33-00109.

D

SPECIFIC VALUES: For the fasteners listed below, use the indicated values:

D

FASTENER	THREAD SIZE	MAT'L GRADE	TORQUE FT/LB	REMARKS
Bumper mounting bolts	½-12 UNC	2-3	32-38	Stainless Steel
Bumper mounting bolts	5/8-11 UNC	2-3	70-75	Stainless Steel

COMPILED	HJR
APPRV	
ISSUE DATE	09/19/85
REV DATE	04/25/94
CHG LTR	G

SHOP PRACTICE

CONTENTS

INSTRUMENTS AND ACCESSORIES

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-22100

PA2101-04

	PRACTICE NO.	DESCRIPTION
	33-22101	WATER TEMPERATURE GAGE SENSING UNIT INSTALLATION
	33-22102	INSTRUMENT DRIVE CABLE INSTALLATION
	33-22103	ARGO ANGLE DRIVE ADAPTORS
	33-22109	FUEL/WATER SEPARATOR INSTALLATION
	33-22201	HEATER INSTALLATION (GENERAL)
	33-22203	LUBRICATION, OIL MIST SYSTEM
	33-22206	AIR HORN AND VALVE INSTALLATION
	33-22207	WATER FILTER INSTALLATION
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G	33-22213	AIR OPERATED WINDOW INSTALLATION
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F		
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G	33-22239	LEAK CHECK, A/C SYSTEM

COMPILED	H J R
APPRV	D M
ISSUE DATE	08/11/66
REV DATE	07/29/96
CHG LTR	A

SHOP PRACTICE

SENSING UNIT INSTALLATION WATER TEMPERATURE GAGE

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-22101

PAGE
1 OF 1

PA2042-72

REFER TO IMIS (INTERGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-001 FOR WATER TEMPERATURE GAGE SENSING UNIT INSTALLATION.

Compiled	H. J. R.	SHOP PRACTICE SENSING UNIT INSTALLATION WATER TEMPERATURE GAGE	33-22101
Approved	[signature]		
Issued	8-11-66		
Revised	1-12-68	Chng Ltr:	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

When a capillary type water temperature gage is to be installed a certain amount of care must be observed to ensure proper installation for long, trouble-free operation.

For best results:

1. Handle the indicating instrument, capillary tube and bulb with care at all times.

2. Route and secure the capillary tube away from hazards that might cause wear or other damage, but not through the main cab harness.

3. Avoid sharp bends -- the tube may not be obstructed, but chance of fatigue failure is increased.

4. Don't pull, twist, or bend the capillary tube where it enters the bulb. Damage here is most likely to occur when tightening the threaded bushing holding the sensing bulb in its mounting hole; proper alignment and seating of parts is essential. Avoid over-tightening of parts.

When an instrument installed in the vehicle is found defective, it should be:

1. Removed from the vehicle carefully, without further damage.

2. Tagged as defective.

3. Carefully packed and sent to Quality Control for analysis of difficulty, return to vendor, etc.

Lubrication

F To meet the conditions of minimal friction, a light coating of 48-02452-000 lubricating grease (one gram per foot) is applied just before the core is inserted in the housing. The grease is applied at the mouth of the housing and then blown through the housing with a blast of compressed air.

Under no circumstances should the housing be packed with lubricant. Drag on the rotating core would be excessive for the length of cable usually involved, especially in cold weather.

Installation

Good cable installation practice helps assure a minimum of erratic motion of the instrument end of the core, and consequent longer life for the instrument. It does this by reducing the chance of "stick-slip" friction between the core and housing, and the rotational vibration of the core due to passing tight bends, pinched or kinked housings and bent or frayed core, etc.

CAUTION:

F
a. Do not kink cable housing.
b. The centerline diameter of bends in the cable housing should never be less than 12.00 inches and preferably not less than 16.00 inches.
c. All clamps must be tight around conduit. (Except at cab pivot.)
d. Anchor clamps to stable structure - do not attach the housing to hose, wiring, other conduits, or bundles.
e. Route cables away from hot pipes and other hazards.

A. Routing

The same general considerations apply to routing of drive cable from place to place on the vehicle as apply to routing of flexible hose. (Ref. 33-12101). The main considerations are, for convenience, briefly recapitulated here:

1. All cables must be routed so that routinely serviceable components (i.e., fuel filters, fuel water separators, oil filters, air cleaners, dip sticks, belt drives) can be readily accessed for adjustment or element removal without the need to relocate or remove the cables.

F
2. Route cables as directly as is practical, using large radius bends. Bends should have 8" or more radius preferred with 6" radius the minimum allowed.

ORIGINAL

A. Routing (Continued)

3. Avoid putting the cable near (or especially, over) sources of intense heat, such as the engine exhaust system, without the use of proper shielding. F

4. Avoid exposing the cable to damage from ice accumulation, from wheel splash, etc. F

5. Keep cables safely clear of places where they may be stepped on. F

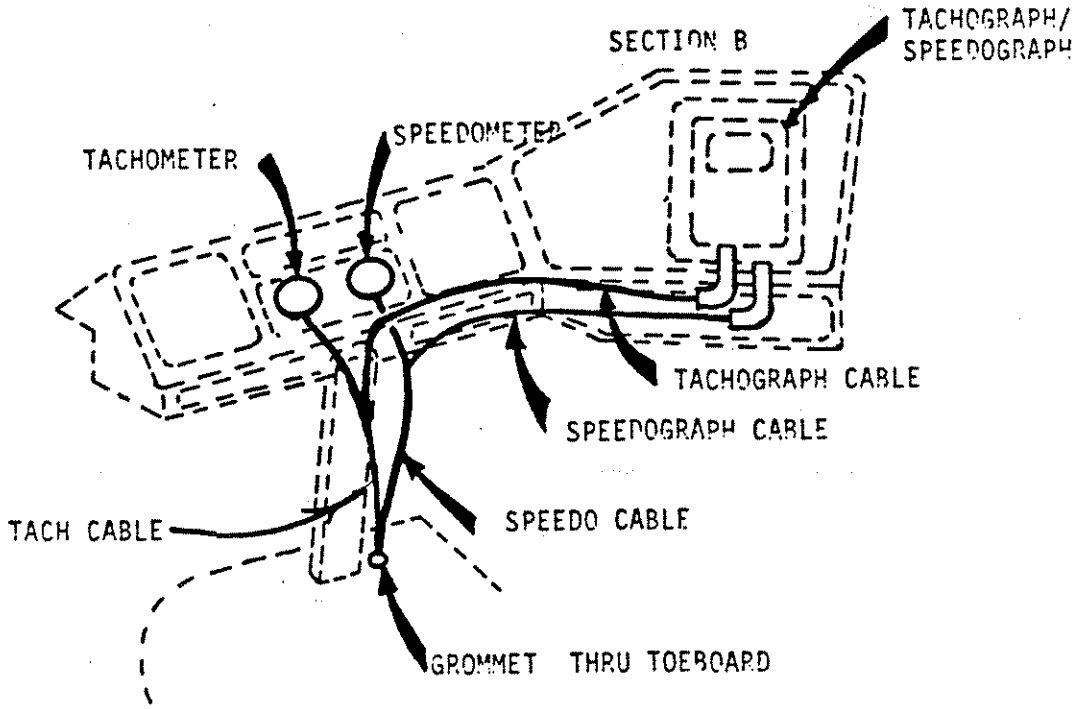
6. Keep cables anchored securely at a safe distance from moving parts. F

7. Torque the instrument end cable nut to 50 ± 10 in-lbs. F

7.5 Do not remove the protective plastic cap from the speedo or tach head. The cable ferrule and nut are designed to fit over the cap. F

8. Torque the transmission (speedo), engine (tach) and intermediate coupling cable nuts to 100 ± 20 in-lbs.

COE TACHOMETER, SPEEDOMETER & TACHOGRAPH CABLE ROUTING: F



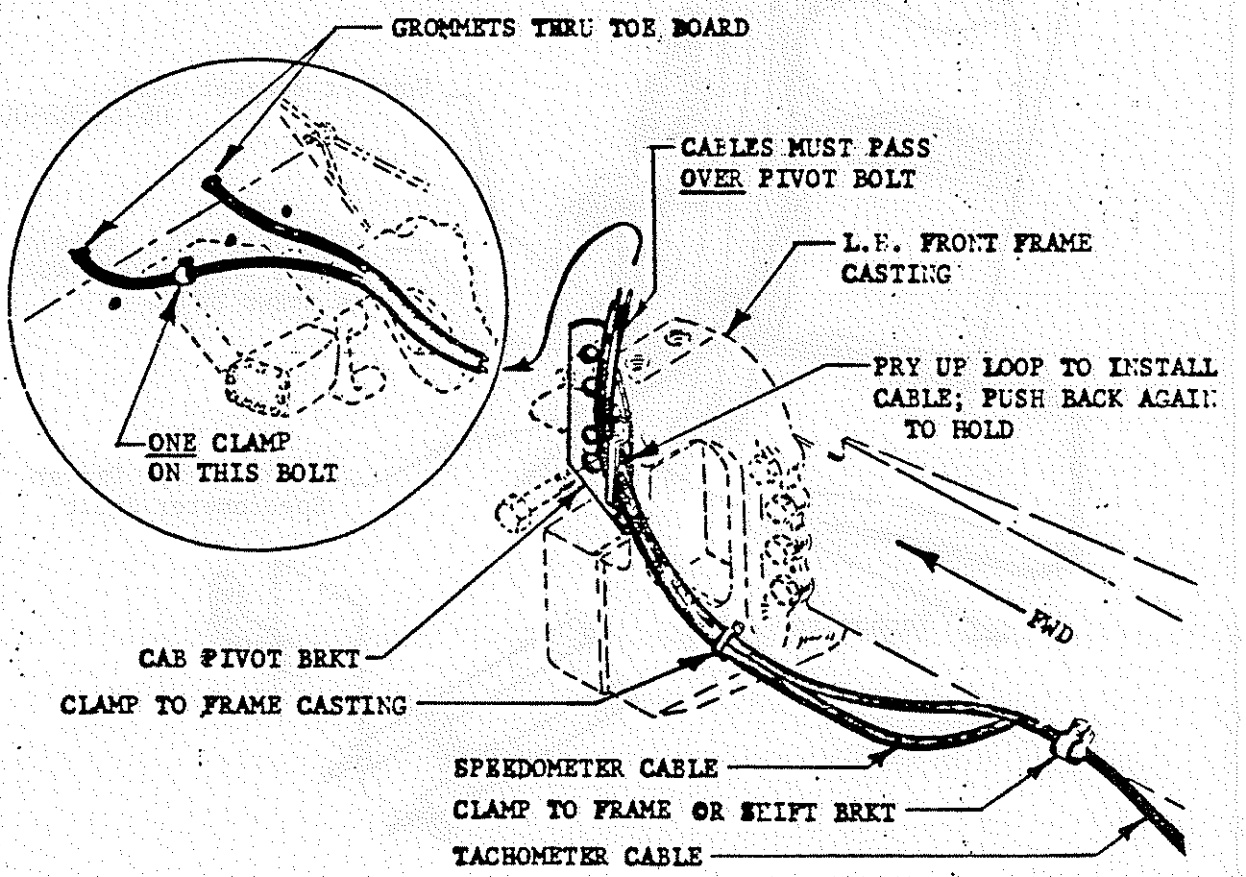
ORIGINAL

A. Routing (Continued)

COE TOE BOARD TO INSTRUMENT PANEL ROUTING

- Holes in deck to be positioned per D22-33209-000
- F After installation of cables and instrument panels, hand turn shaft at opposite (drive) end to ensure free movement (should not exceed 8 in-ozs)

CAB DECK TO FRAME, VIA CAB PIVOT
STD. CAB

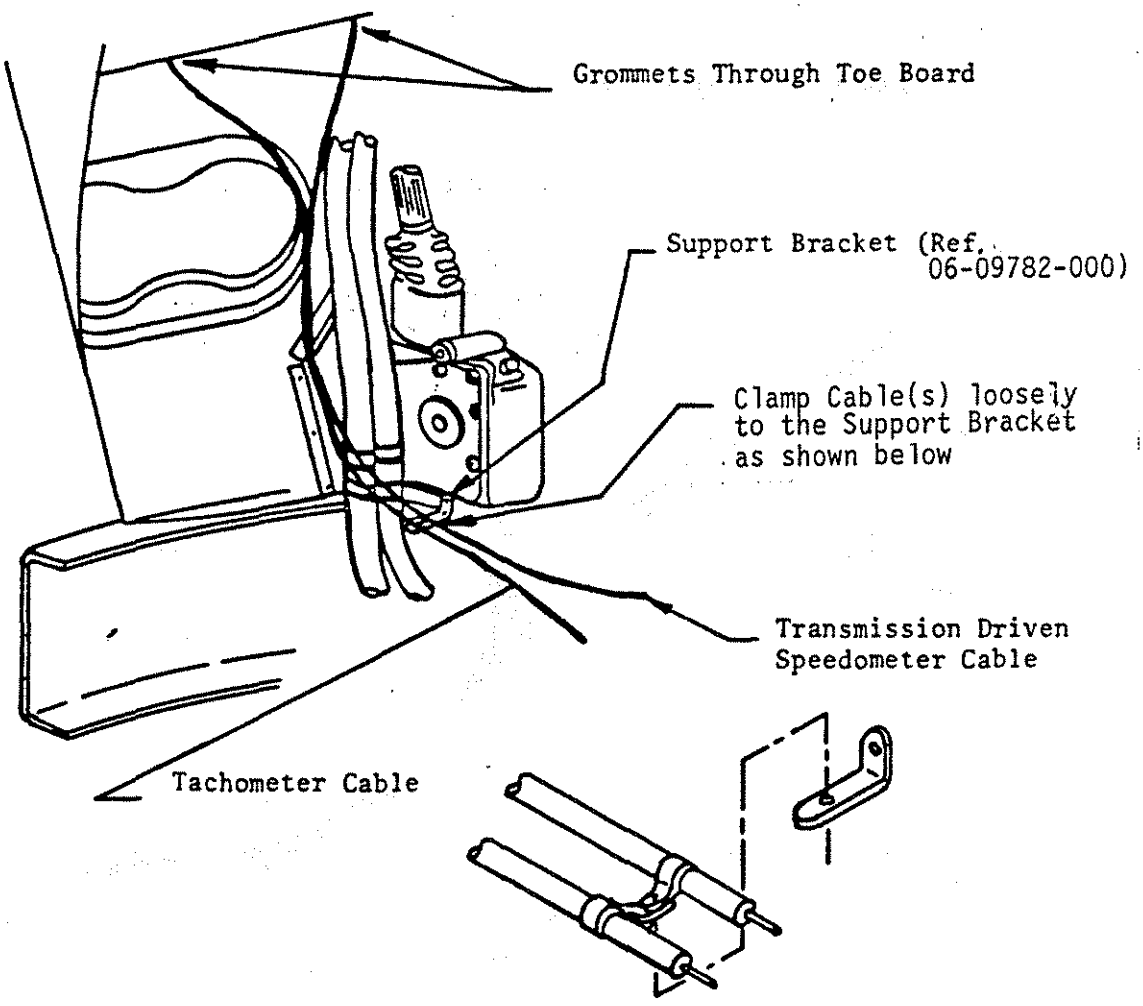


F

ORIGINAL

A. Routing (Continued)

CAB DECK TO FRAME, VIA STEERING BOX



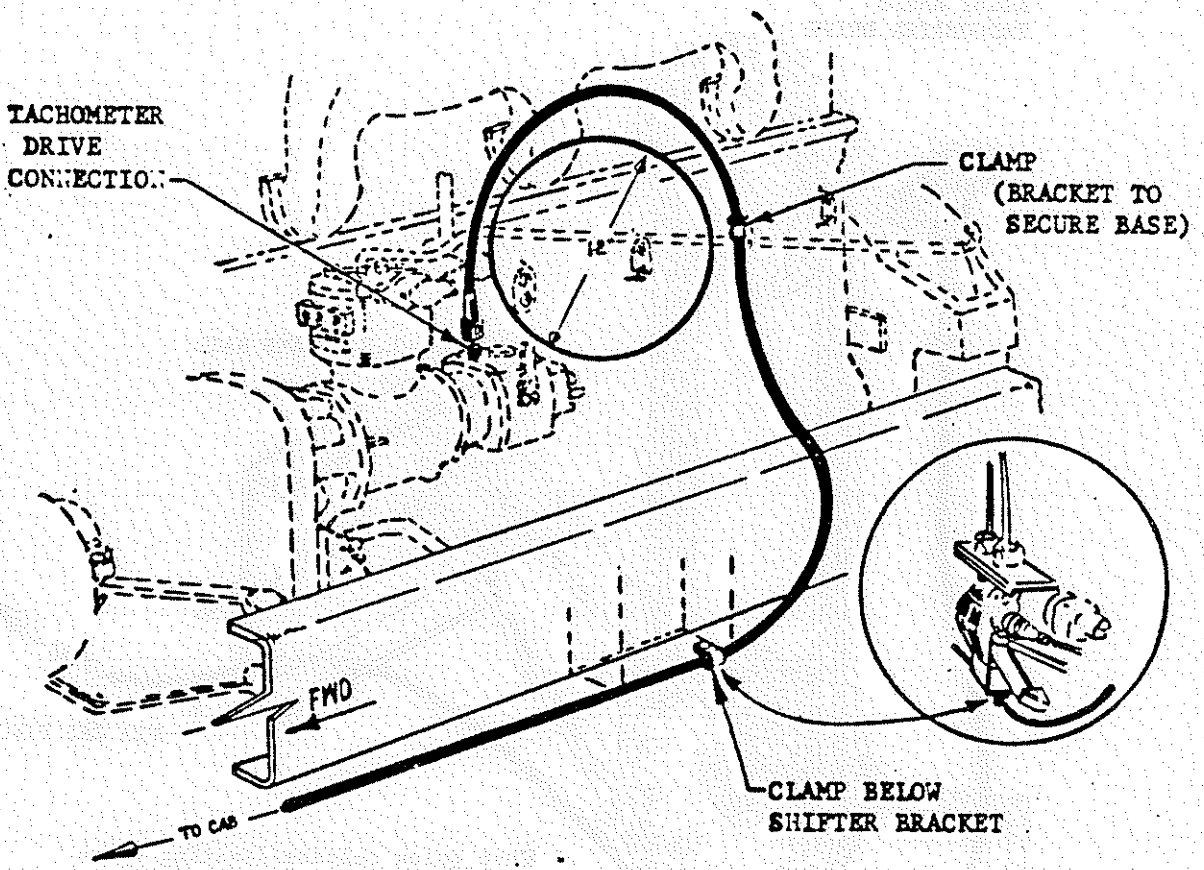
F

F

ORIGINAL

A. Routing (Continued)

TACHOMETER DRIVE
CUMMINS IN-LINE SIX

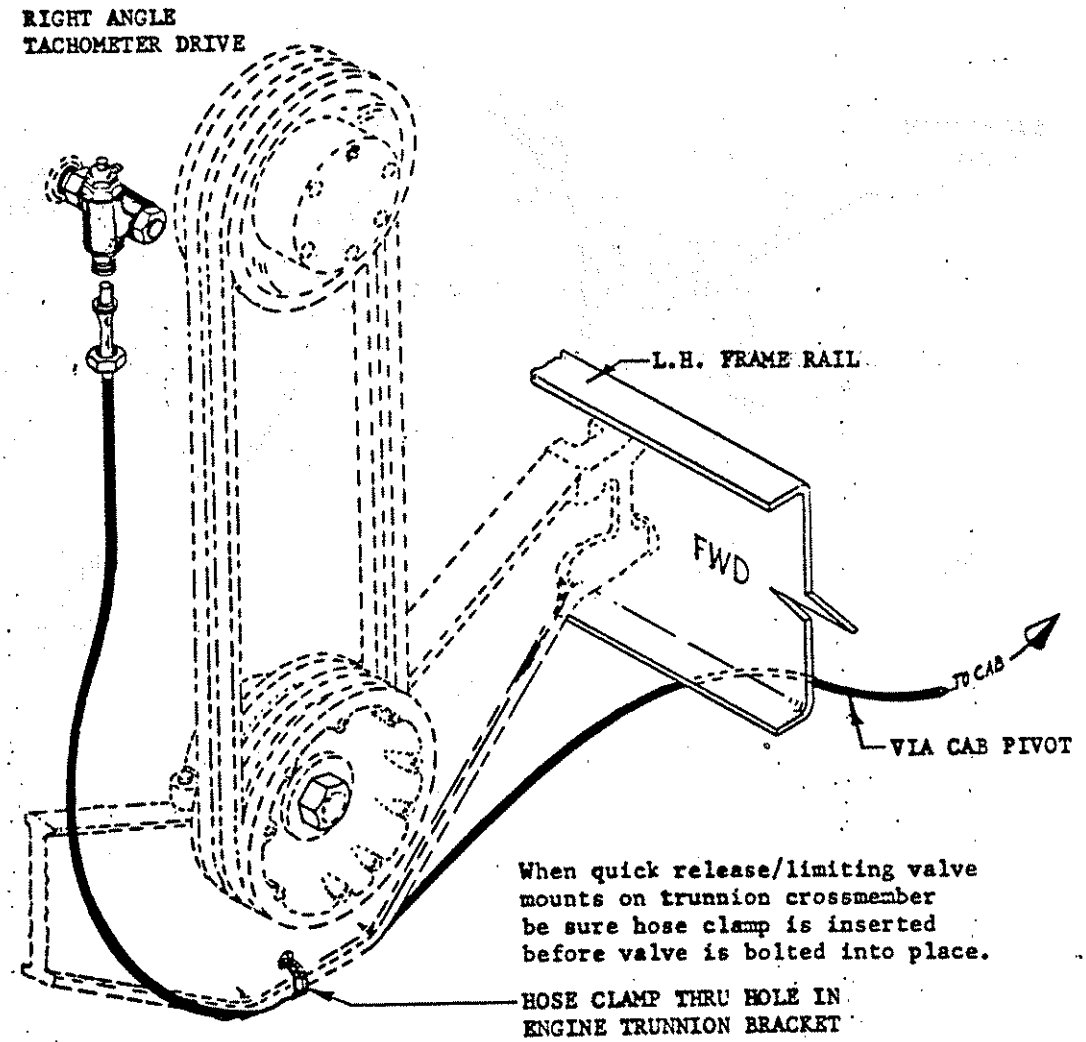


F

ORIGINAL

A. Routing (Continued)

TACHOMETER DRIVE
DDE 6V, 8V



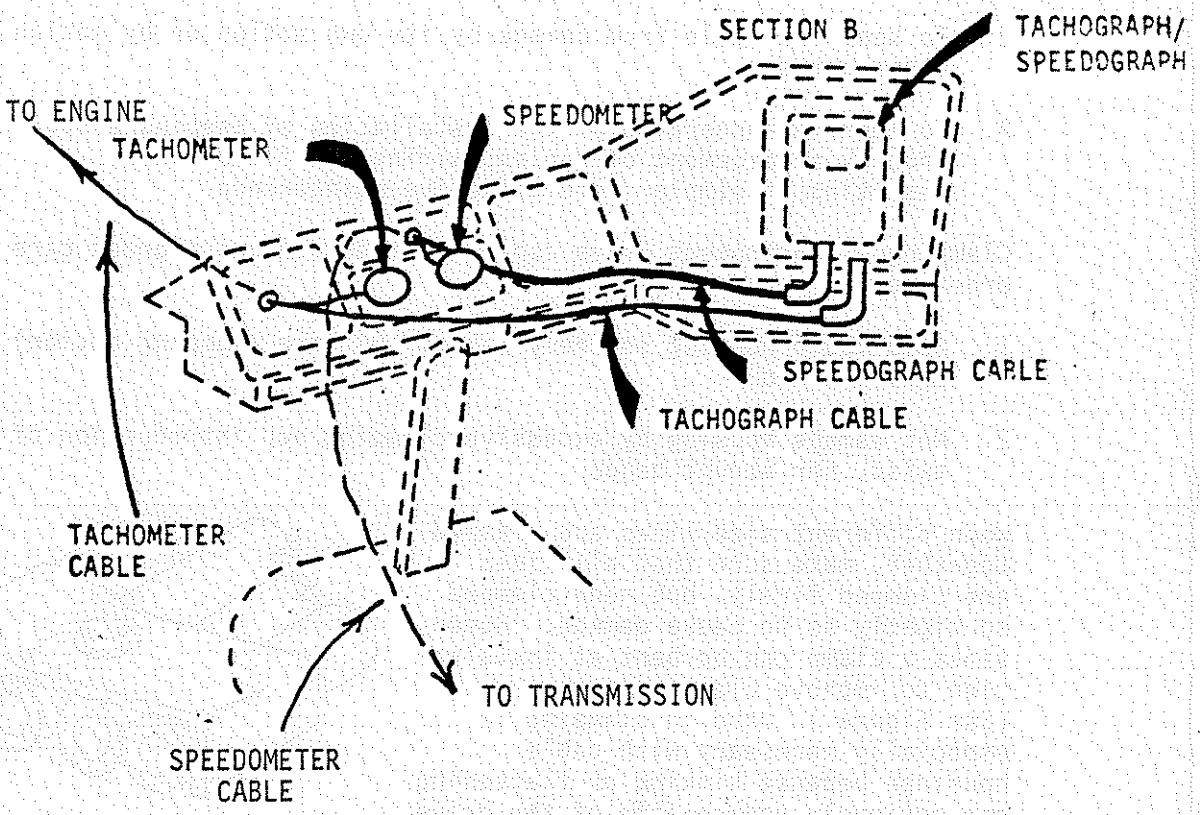
F

ORIGINAL

A. Routing (Continued)

CONVENTIONAL CAB WITH ROUTING FOR MECHANICAL SPEEDOMETER, TACHOMETER, OR TACHOGRAPH THROUGH THE NOSE SKIN.

F



F

- Holes in nose skin to be positioned per D22-33156-000 and cables route per D22-33167-000
- After installation of cables, hand turn shaft at opposite end to ensure free movement (should not exceed 8 in-ozs)

ORIGINAL

Installation (Continued)

B. Clamping

The purposes of clamping are:

1. To hold the cable in its most favorable operating position.

2. To keep the cable from damage by its own motion or by motion of other parts.

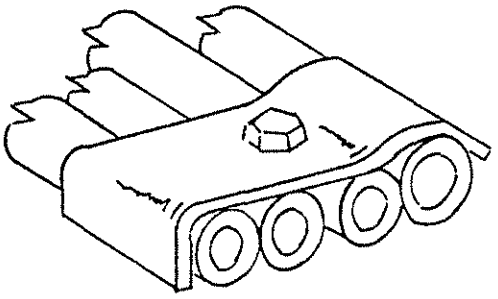
3. To improve appearance of the installation by keeping a neat and orderly arrangement of cables, wiring and fluid lines, resulting in simpler more effective maintenance.

Clamping of instrument drive cables must be done with great care in order to:

1. Hold cable housing securely (about .03 inch clamping action) in position and

2. Not damage housing by excessive clamping nor introduction of twist, nor abrupt bends

When different size lines are clamped together, make sure that all lines are clamped firmly, but none clamped so tightly as to cause damage. Sometimes a clamp can be bent at installation to improve clamping action. (See Figure.) Care in clamping is especially necessary with cable housings because kinking or flattening can seriously reduce life of the drive.



3. In the COE, cab tilt area clamps must allow cable travel as the cab is raised or lowered to prevent cable binding or stretching. Clamps in this area are to act as guides only. F

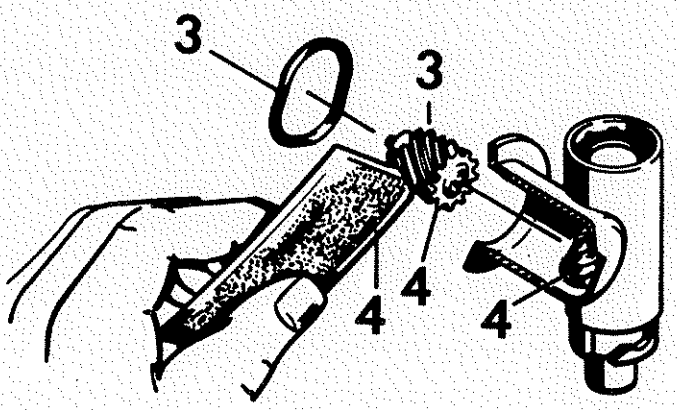
ORIGINAL

Compiled	N. RITCHIE	SHOP PRACTICE ARGO GRAPH ANGLE DRIVE ADAPTERS	33-22103
Approved	N.E.R		
Issued	10-15-85		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	

ARGO GRAPHS WITH ANGLE DRIVE ADAPTERS

When using angle drive adapters, the graph head must be modified as follows:

1. Remove connecting flange.
2. Discard the felt rings.
3. Insert the equalizing washer provided with the angle drive.
4. Fill each tooth space of the angle drive gears with the lubricant provided with the drive.



Compiled	H.J.R.	SHOP PRACTICE TACHOMETER INSTALLATION	33-22103
Approved	E.TRAUB		
Issued	12-22-67		
Revised	1-18-71	Chng Ltr: C FREIGHTLINER CORPORATION PORTLAND, OREGON	

C. MOTOROLA TACHOMETER, ALTERNATOR SENSING

When adjusting a Motorola Tachometer use a screw driver having a non-conductive (plastic) blade. Any use of an ordinary metal blade screwdriver will interfere with proper calibration of the instrument.

A The Motorola tachometer head needs additional grounding to prevent erratic operation after being in service for a period of time. (Ref. 33-06102 for more on grounding.) The following methods of grounding should be followed:

(Wire size given is minimum.)

1. Motorola Tachometer with Motorola Alternator

   a. The ground post of the tachometer should have a #14 wire direct to the alternator case (circuit 112).

   b. A #14 wire should be connected from the ground terminal to the mounting bracket stud. Another #14 jumper wire should be connected from the mounting bracket stud to the voltmeter ground terminal. This completes a ground circuit to the nose beam.

2. Motorola Tachometer with Delco 85 Amp Alternator

   The two tachometer terminals should have #14 wires direct to the alternator phase taps. There must be no grounding of these circuits.

C 3. Do not use Motorola alternator sensing tachometers with Delco Remy 62 amp alternators.

OBSOLETE 2-1-74

COMPILED	L M
APPRV	D L R
ISSUE DATE	04/04/80
REV DATE	07/29/96
CHG LTR	A

SHOP PRACTICE

FUEL/WATER SEPARATOR PLUMBING

FREIGHTLINER CORPORATION
PORTLAND, OREGON

SECTION NUMBER
33-22109

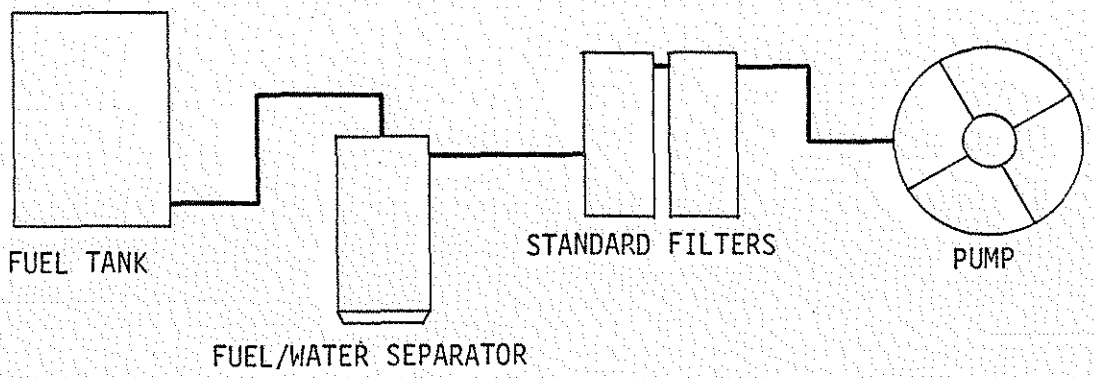
PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-002 FOR FUEL/WATER SEPARATOR PLUMBING.

Compiled	L.Murrell	SHOP PRACTICE FUEL/WATER SEPARATOR PLUMBING	33-22109
Approved	DCR		
Issued	4-4-80		
Revised		Chg Ltr **FREIGHTLINER CORPORATION** PORTLAND, OREGON	

Plumbing Schematic

Unless the chassis specification sheet contains instructions to the contrary, the fuel water separator is to be plumbed as follows.



COMPILED	BBK	SHOP PRACTICE HEATER INSTALLATION	SECTION NUMBER 33-22201
APPRV	KOEPKE		
ISSUE DATE	05/01/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-003 FOR HEATER INSTALLATION PROCEDURE.

A. GENERAL

Cab heater systems circulate a portion of the engine coolant through hoses, fittings, and a radiating unit ("heater core"). Thus the heater system is a branch of the engine cooling system and must meet strict requirements of freedom from leakage and, especially, from possible catastrophic loss of coolant.

B. HOSE INSTALLATION

When installing heater hose observe the following precautions:

1. Use only good quality, clean, undamaged hose of the proper size and length.

2. Protect from external damage by routing away from hazards of heat, wheel splash (water, gravel, ice), human traffic and moving parts of the vehicle. (Hoses must be routed at least 4.00" away from heat source. If that is not possible a heat shield must be used.)

3. Secure properly with a sufficient number of rubber cushioned clamps.

4. Provide necessary slack for flexing, extension, etc.

5. Clamp the hose properly at its end connections so that it cannot pull or work free during operation of the vehicle:

   a. Use no sealant between the hose and nipple, and no grease.

   b. Push hose onto nipple as far as necessary for as much contact between them as possible.

   c. Place hose clamp carefully in the proper position on the hose (usually midway along the length of contact between hose and nipple) and tighten to 30 $\pm$ 5 in. lbs. of torque.

6. All hoses must be routed so that routinely servicable components (i.e., fuel filters, fuel water separators, oil filters, air cleaners, dip sticks, belt drivers) can be readily accessed for adjustment or element removal without the need to relocate or remove any hoses.

C. INSTALLATION OF HEATER FITTINGS

When installing fittings in the heater system, observe the following precautions:

1. Use only specified high quality fittings in good physical condition, especially as to mating surfaces such as screq threads, flange faces, etc.

C. INSTALLATION OF HEATER FITTINGS (continued)

2. Install fittings correctly, observing conservative practice as to tightness.

3. Choose type and placement of fittings to achieve a minimum of flow restriction, economy of number of pieces, ease of installation, and ease of servicing and replacement.

4. On pipe threads use sealant as per ref. 33-00114 especially on fitting joints to the core so they need not be drawn so tightly as to cause damage, nor left so loose as to leak.

5. Adjust fittings to proper direction to relieve the hose of as much strain as possible.

6. Locate the heater shut-off valve on the inlet side of the heater to avoid possible damage to the heater core from full output pressure of the waterpump (on some engines this may be nearly 30 psi. with a downstream valve closed).

D. INSTALLING THE HEATER IN THE CAB

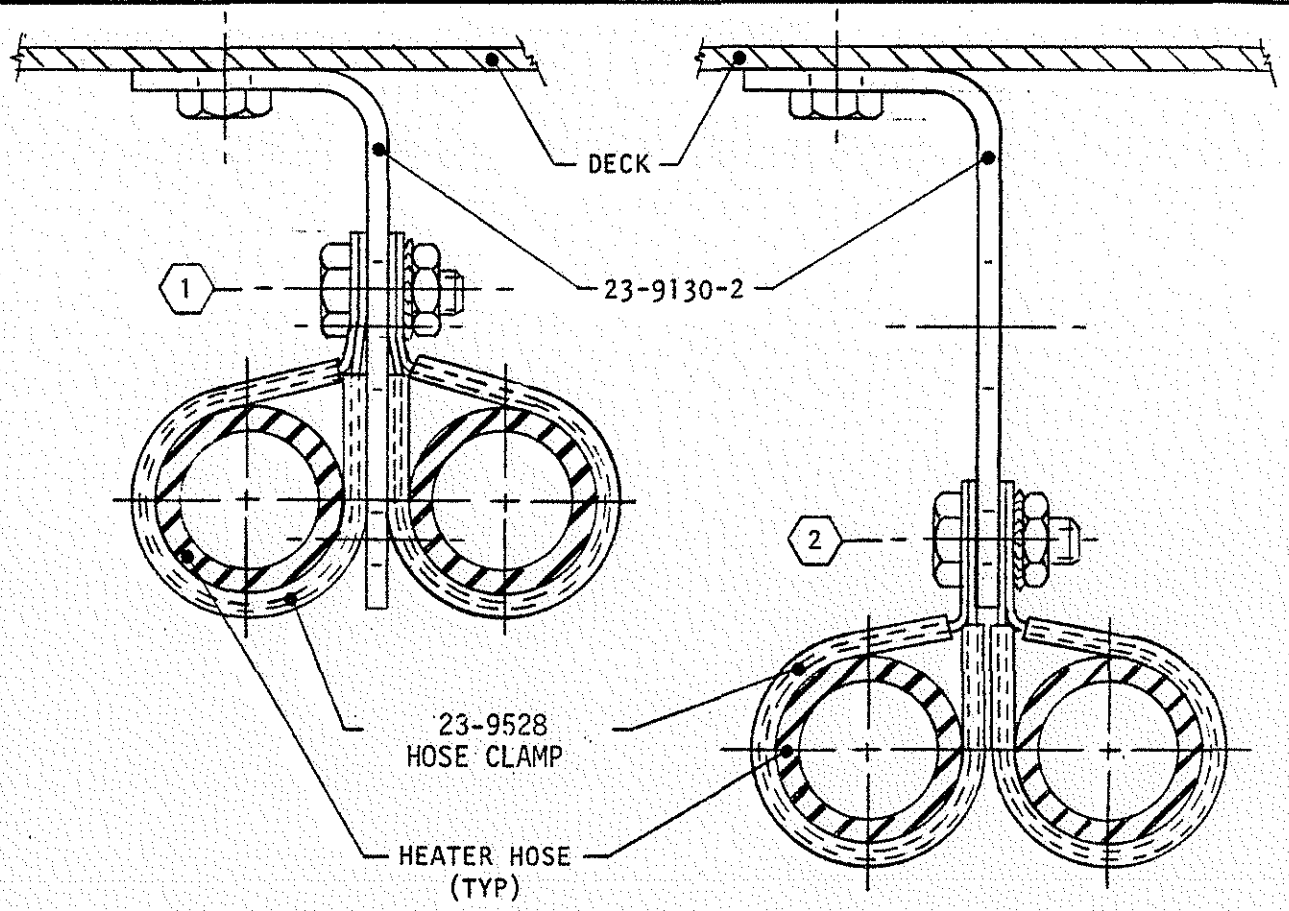
Never put any strain on the heater core inlet and outlet fittings. This means:

1. Do not press or stand on top of the housing at any time either during or after installation.

2. While putting the heater in place push only on the fittings next to the hose or rubber elbow making the connection.

3. After installation is completed avoid any heavy loads on the piping, fittings, or housing.

4. Ref. D22-23606 & D22-23657.



REAR CLAMPS
(By Step & Heater Elbows)

FORWARD CLAMPS
(By Clutch Cross Shaft)

(1) Locate clamps in upper end of slot on 23-9130-2 brkt.

(2) Locate clamps in bottom hole on 23-9130-2 brkt.

Compiled	H.J.R.	SHOP PRACTICE	33-22202
Approved		AIR CONDITIONER, KYSOR*	
Issued	9/28/65		
Revised	1-12-68	Chng Ltr: FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

Roof Unit

1. Establish a suitable location on cab top for E-20000 Air Conditioner unit (preferably as near to the rear curvature of cab top as practicable) and on this location lay template (Dwg. No. E-18536). Drill four 13/32 dia. mounting holes thru cab top & cut large opening for air transfer chamber.
2. If air conditioner has a rubber joint seal boot between air conditioner and cab roof, it is necessary to remove all paint from cab roof area that comes in contact with joint seal flange (approximately 2" wide area around air transfer chamber opening). Clean contact surface of joint seal boot and cab roof area using cleaner supplied with kit and a clean paint brush. Be sure all surfaces are clean and free of dust and dirt. Cleaning to be done just prior to cementing. Using cement furnished in kit, apply to joint seal boot flange. Brush on evenly and be sure to cover full surface. Apply cement around air transfer chamber opening. Brush evenly covering approximately 1" or more of cleaned surface. To maintain proper cement consistency, thin with cement cleaner. Position air conditioner in place, block unit approximately 3" above cab roof surface to enable hands to be inserted between cab roof and air conditioner frame to firmly press joint seal boot to cab roof surface. Work all air pockets from under joint seal boot flange. Be sure flange is smooth on cab roof surface. Press down firmly. Remove temporary blocks and install air conditioner rubber mounts.
3. If air conditioner has a compression seal ring instead of the joint seal boot, install as follows:
   Air conditioner unit should be parallel to and a minimum of 1¼" above cab roof. Clean contact surface of seal ring (already attached to air conditioner) and cab roof with cleaner supplied in kit. It is necessary to remove paint around air transfer chamber opening. Spread a thin film of cement around opening in cab roof and on bottom surface of seal ring. Due to the fast drying solvent used in this adhesive, the two surfaces can be bonded at room temperature within 5 minutes after application. However, for best results at room temperature, a 20 minute delay is recommended. As soon as bonding has been completed, tighten all four mounting screws from inside of cab to 4 foot pounds torque, or until compression ring is compressed 1/4" to 3/8". The weight of air conditioner and tightening of mounting bolts will provide sufficient pressure on seal ring to insure a permanent seal.
4. Choose any suitable arrangement of leveling cab top unit, using material furnished per accompanying Bill of Material & illustrated, in part, on Fig. "A", "B" and "C". It is advisable to maintain a minimum of clearance between cab top and base of unit to minimize top-heaviness.
5. Leveling of unit is accomplished by "stacking" a number of washers (4 max.) - Item No. 5 - on each mounting screw and rotating these washers in such a manner as to provide a horizotal mounting surface at the top for a true contact on base of unit. If truck roof is level, flat washers will be provided rather than the wedge type (See illustration). A correction of 20° maximum of cab top slope can be obtained by using 4 wedge type washers (or 10° with two washers) on each screw.
6. Before permanently mounting unit in place, apply a non-hardening sealer (Permatex No. 2 or equal) at junction of cab top and screws (See Fig. "A") to prevent seepage of water into cab.
7. If cab roof does not provide adequate support for air conditioner it must be reinforced (either inside or outside). Steel strips about 1/8" thick by 2½" to 4" wide is sufficient. However, custom-engineered roof reinforcing kits for most truck makes are available from the factory. Follow instructions included with kit.

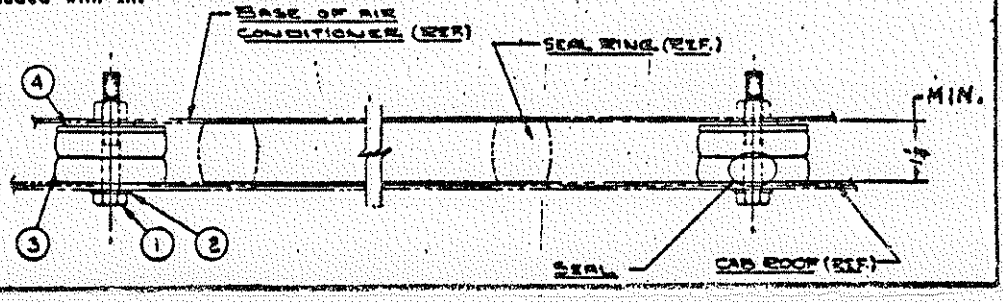
Drive Belt

It is essential that belts be installed on the drive without forcing. The textile fiber cords in the present day V-Belts have low stretch characteristics. When a bolt is forced onto a drive by using a screwdriver, or cranking, or other means, the cords are almost certain to be injured. The damage is encountered when only one or two of the cords on one side of a bolt are fractured during installation; for often, to outward appearance, the belt is still intact and sound. When it is put in service, it sometimes will run for a few hours after which the injured cords fail completely and the unbalanced belt turns over in the groove and tears itself to pieces, or falls off the belt train. When a belt fails in the first few hours or days of operation, it is obvious that it was injured during installation. Overtightening of belts by use of crowbars, etc., will also cause clutch and compressor bearing failure. Several companies are now marketing practical truck belt tension gages. One company that has an acceptable gage is Burroughs Tool & Equipment Corp., 2429 N. Burdick St. Kalamazoo, Mich.

BILL OF MATERIAL

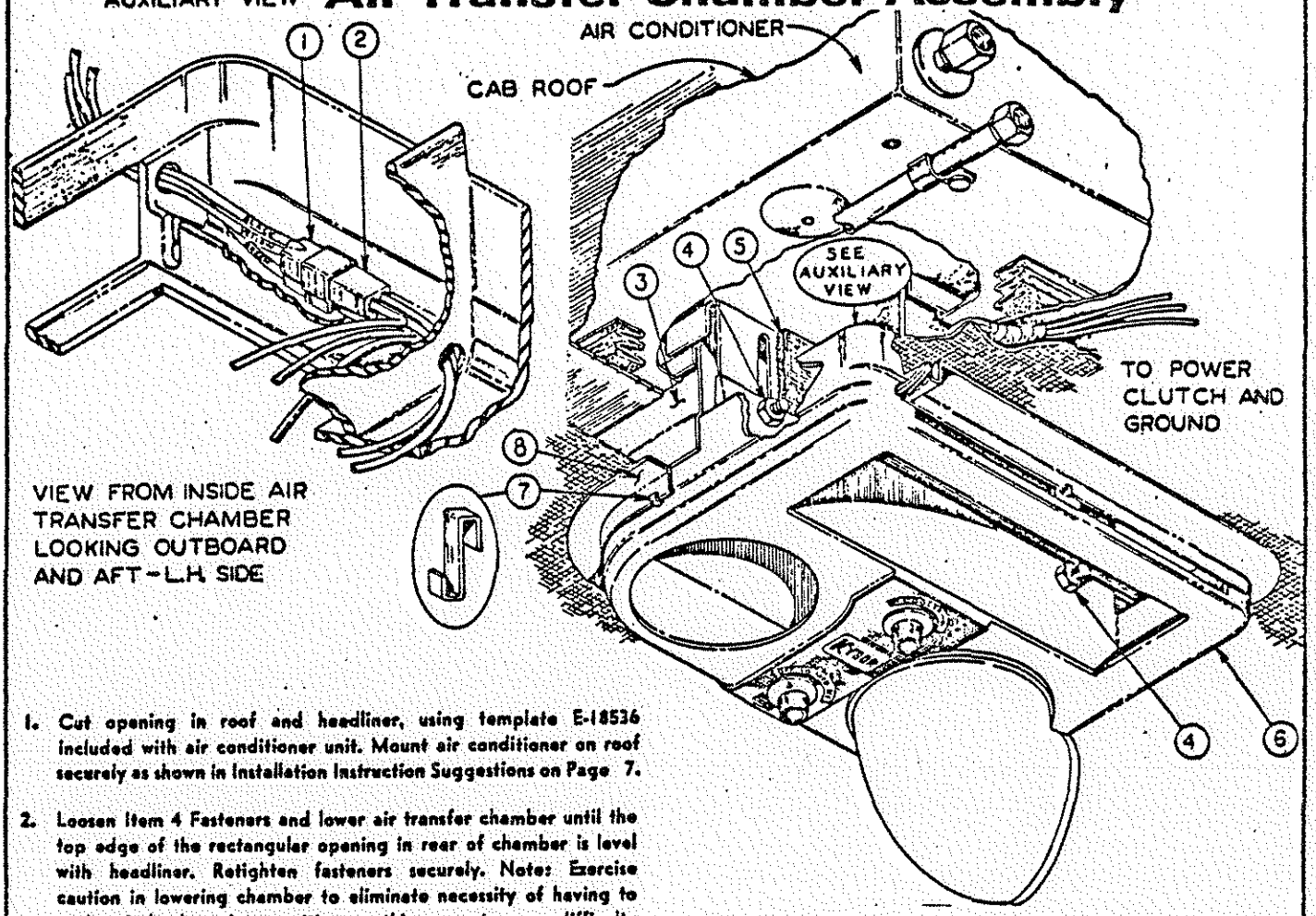
Item	Part No.	No. Req.	Description
1	B-14687-40	4	3/8-24 N.F.X. 2½ Hex. Cap Screw
2	B-11524-12	4	3/8 S.A.E. Flat Washer
3	B-19577	8	Spacer Washer
4	B-14686	4	Off-Set Washer

FLAT WASHERS

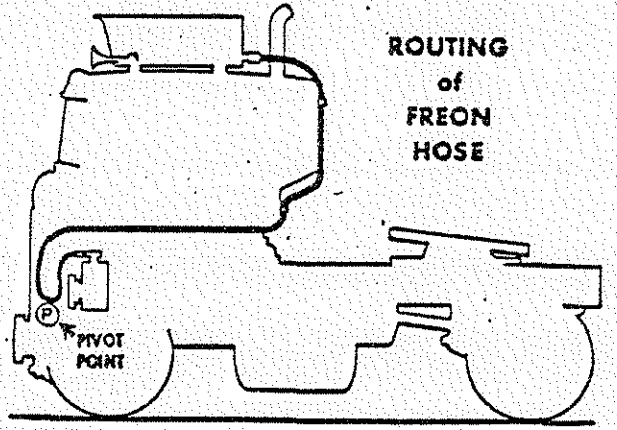


* From Service Manual for Model E-20000 Kysor Truck Cab Air Conditioner, pp. 7-15 dated 5/65, & 9/65

Air Transfer Chamber Assembly



1. Cut opening in roof and headliner, using template E-18536 included with air conditioner unit. Mount air conditioner on roof securely as shown in Installation Instruction Suggestions on Page 7.
2. Loosen Item 4 Fasteners and lower air transfer chamber until the top edge of the rectangular opening in rear of chamber is level with headliner. Retighten fasteners securely. Note: Exercise caution in lowering chamber to eliminate necessity of having to push unit back up into position, as this presents some difficulty due to tight fit of boot.
3. Using sharp knife or razor blade, trim Item 3 Rubber Boot even with headliner.
4. Notch headliner for wiring and insert electrical wires through this notch and hole in rear of air transfer chamber. Insert terminals in Item 1 Connector as shown in auxiliary view above. Care should be taken to insure that indicated wire color coding relationship is maintained when wires are inserted in connector. Plug Item 1 into Item 2 Connector and tuck in channel section of chamber as illustrated.
5. Measure and cut Item 5 Insulation to fit against metal divider wall exposed after chamber has been lowered in position. Insulation has a pressure sensitive backing. Install on metal surface covering the exposed area from top of the plastic chamber divider to underside of drip pan in unit. Failure to install this insulating material will cause condensed water to drip into the cab.
6. Slide Item 8 Trim Flange up snugly against headliner and install Item 7 Clips in holes provided to support trim flange.



- On tilt cab installations always route freon hoses to the pivot point of the cab and from this point to the compressor. This procedure will eliminate tearing of hose, breaking of service valves and deteriation of hose from lying on hot spots of the engine.

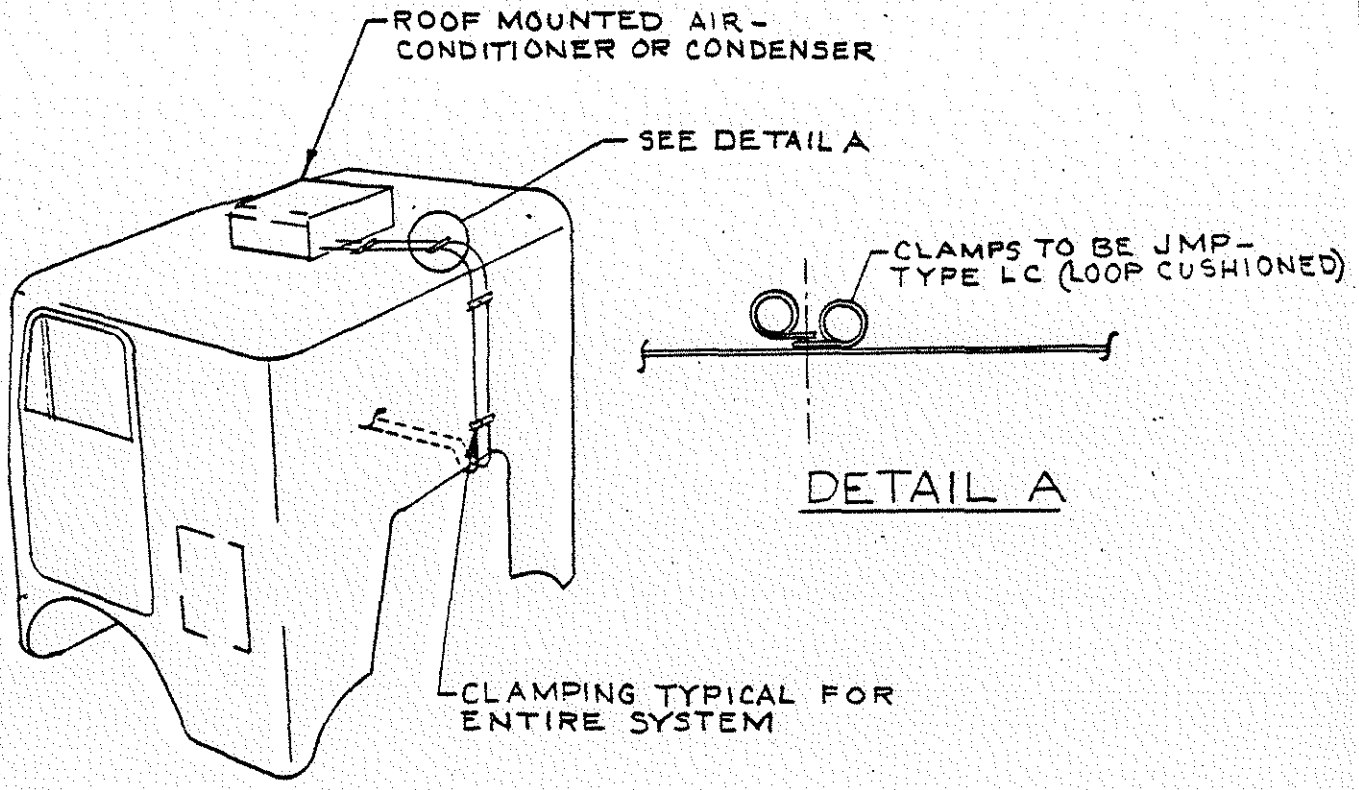
Fasten hoses per sketch on next page.

A

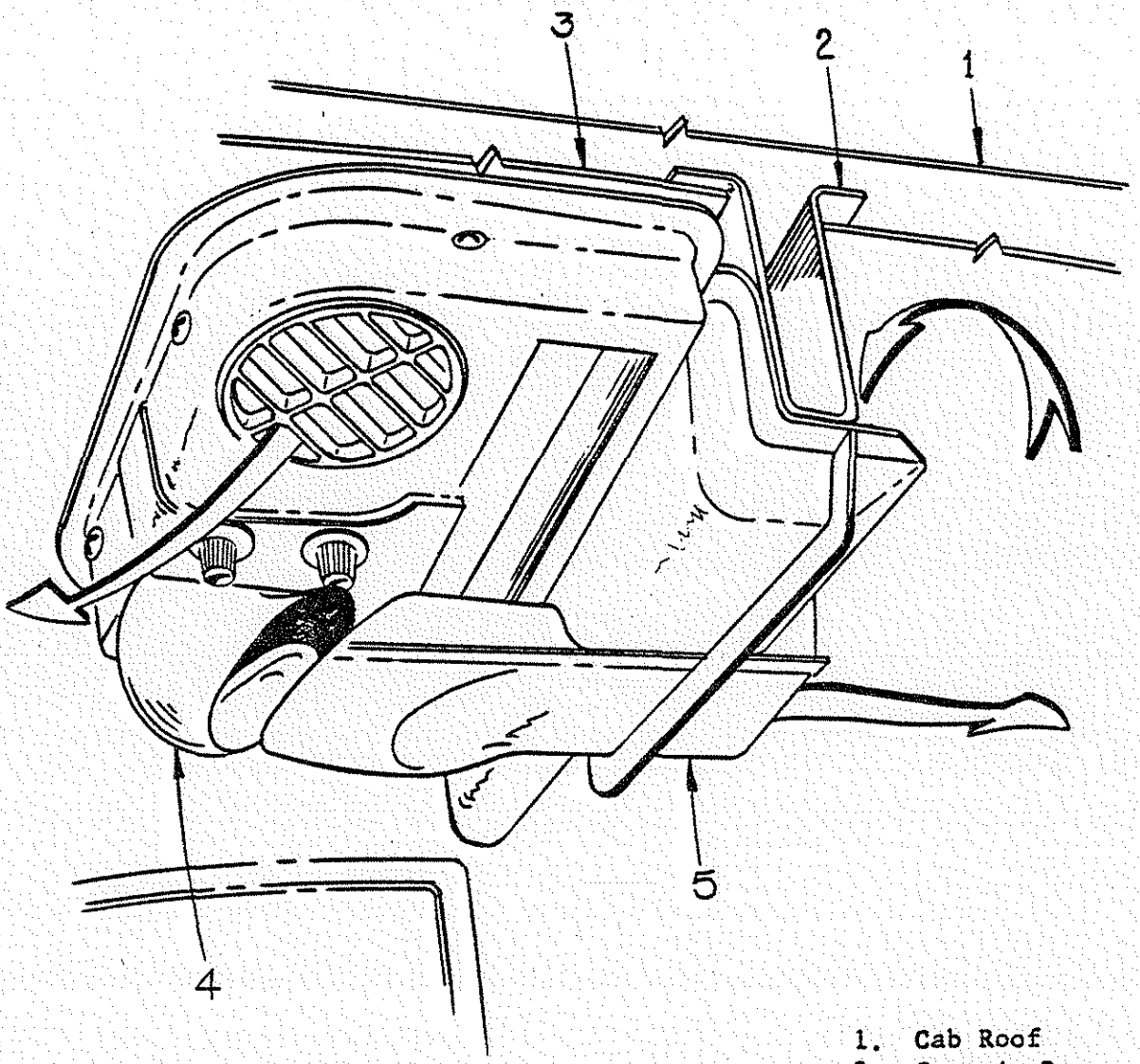
Compiled	H.J.R.	SHOP PRACTICE AIR CONDITIONER, KYSOR	33-22202
Approved	GILLESPIE		
Issued	8-13-73	Chg Ltr A **FREIGHTLINER CORPORATION** PORTLAND, OREGON	3.1
Revised	9-10-73		

FASTENING OF FREON HOSE

A Hoses must be separated as shown to avoid chafing and reduce heat transfer.



FORCED COLD AIR SYSTEM FOR SLEEPER CAB



1. Cab Roof
2. Curtain Bow
3. Cab Liner
4. Elbow
5. Sleeper Duct Assy (FL A22-11311)

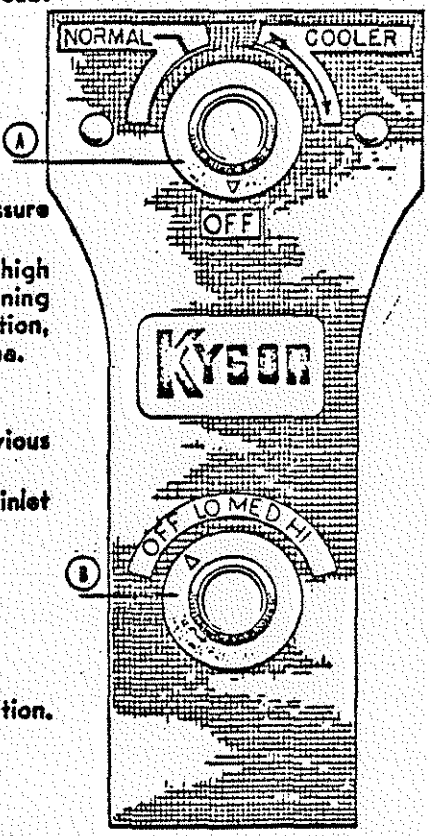
Control of Excessive Air Conditioner Moisture

A. Excessive moisture occuring in truck cab is caused by one or more of the following:

1. IMPROPER OPERATION OF AIR CONDITIONER.

Operating with windows, doors, or vents open, allowing excessive outside ambient air to enter truck cab. This causes:

(1.) Continuous water flowing from evaporator
(2.) Excessive icing of evaporator core
(3.) Excessive compressor wear



2. DRAIN HOSE IMPROPERLY LOCATED.

a. Drain hose should not be located in high pressure area in respect to evaporator core.
b. Drain hose should be cut off above any possible high pressure area at a 45 degree angle, with opening facing rear of vehicle. This will cause a venturi action, pulling excessive water from the evaporator area.

3. MOISTURE FROM OUTSIDE SOURCES.

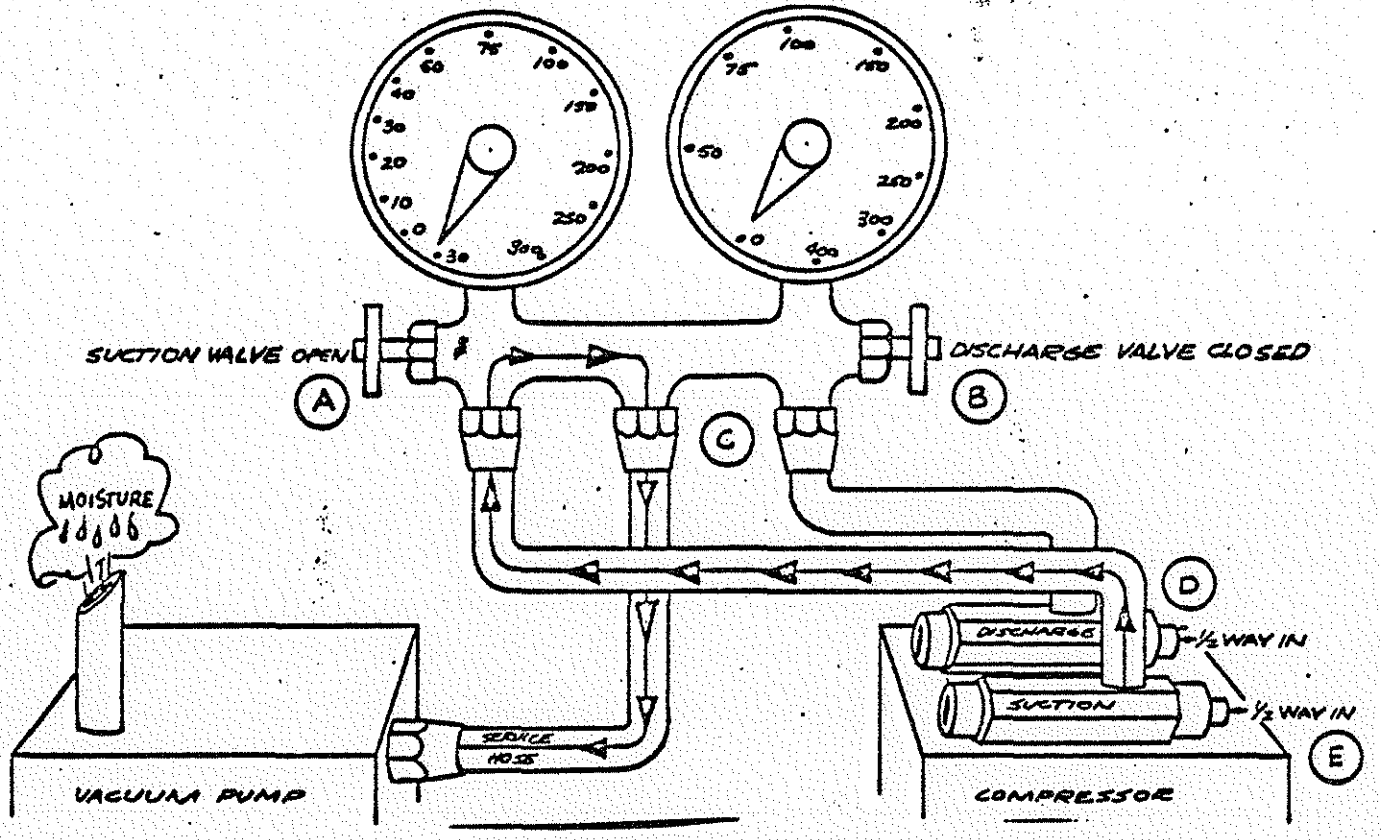
a. Air conditioner to cab-roof seal must be impervious to water and air leaks.
b. Moist outside ambient air will condense on air inlet duct, causing air conditioner to drip water.
c. Rain also can enter cab from same source.

B. PROPER OPERATION OF KYSOR AIR CONDITIONER.

a. Adjust cold control knob "A" to normal position.
b. Close all windows and vents.
c. Operate engine at minimum of 1000 rpm.
d. Turn switch "B" to high speed.
e. After cab has cooled to desired temperature turn switch "B" to medium or low speed.
f. Should the cab continue to cool beyond the comfort zone, adjust cold control "A" to warmer position.
g. When operating in low humidity area (desert area) follow instructions same as above but with "cold" control on full cold. If the evaporator core has a tendency to form ice or loss of cooling is evident, return to normal position.

ON TILT CAB INSTALLATIONS.

When air conditioner has been operating, and it is necessary to tilt cab, water will enter cab from evaporator core when cab is tilted.



Evacuating Air Conditioner

Moisture in the air conditioning system is the cause of more air conditioning failures than all other causes combined. Water vapor and relative humidity cause moisture; and problems arising from this condition are confusing and generally misunderstood. Even one drop of water in the system is in excess of the maximum permissible amount. One drop of water, and a monster is created.

Moisture enters the air conditioning system easily, and is difficult to eliminate. Moisture is picked up by the refrigerant in a fine mist, forming ice crystals at the point of expansion (the expansion valve). The ice crystals will retard or stop the flow of the refrigerant, causing partial cooling or no cooling at all. When the expansion valve warms up due to stoppage of refrigerant, the ice will melt; and the refrigerant will start again until the moisture returns to the expansion valve.

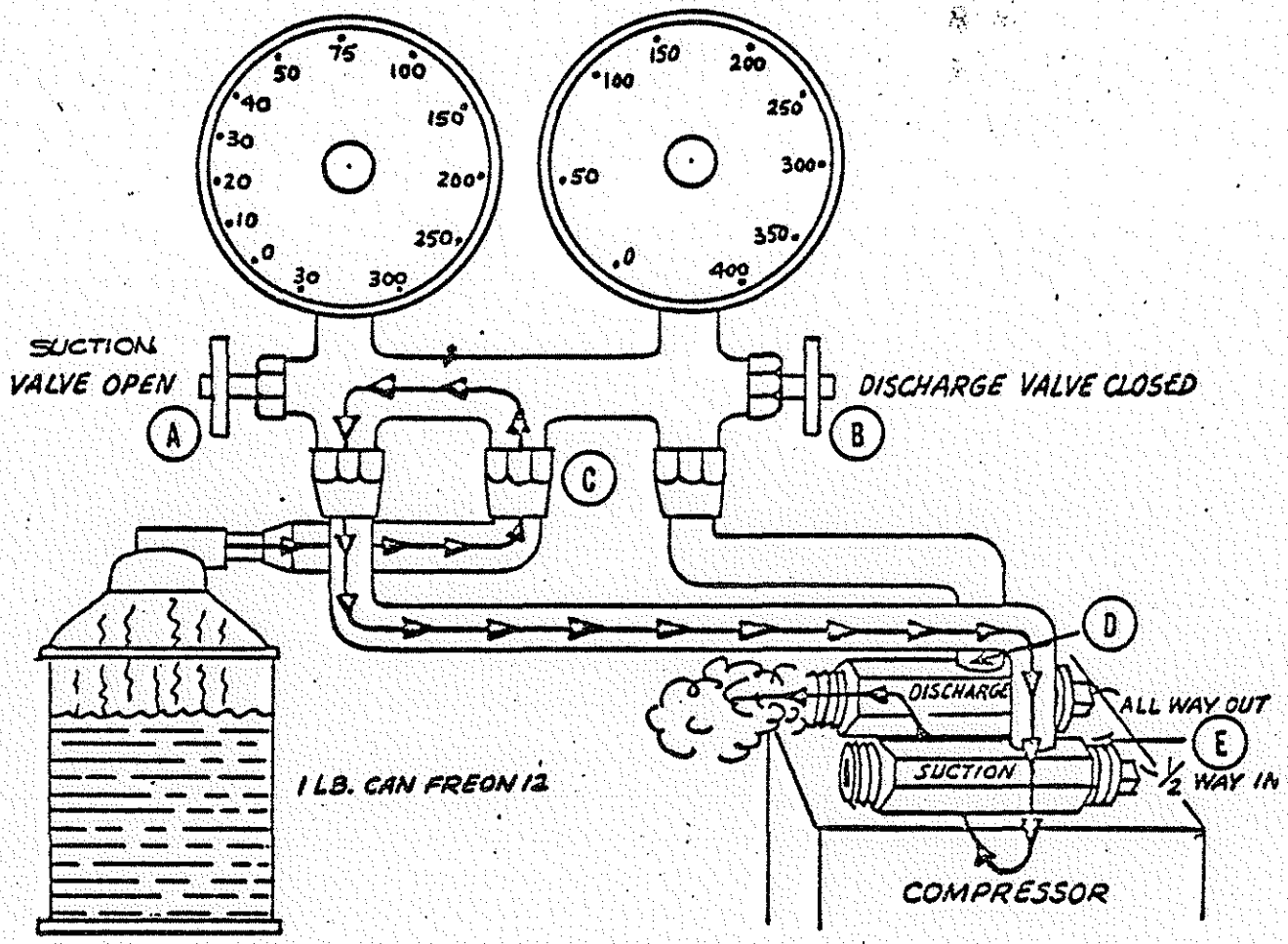
Moisture can also cause corrosion. The effects of corrosion are not apparent until real damage has been done. Moisture itself will cause rust. Water and Refrigerant 12 will form hydrochloric acids. Hydrochloric acid plus heat substantially increases the rate of corrosion.

Refrigerant oil is an exception to the rule "Oil and water do not mix." Refrigerant oil has an affinity for moisture; and if left in an open compressor or uncapped can, becomes sludged. Sludging significantly reduces the lubricating ability of the oil, as well as plugging up fine strainers, expansion valves and tubes.

Do nat add alcohol to the system to prevent freeze-up. The desiccant in the dryer prefers alcohol to water and will discharge moisture to absorb alcohol.

Evacuating The System With a Vacuum Pump

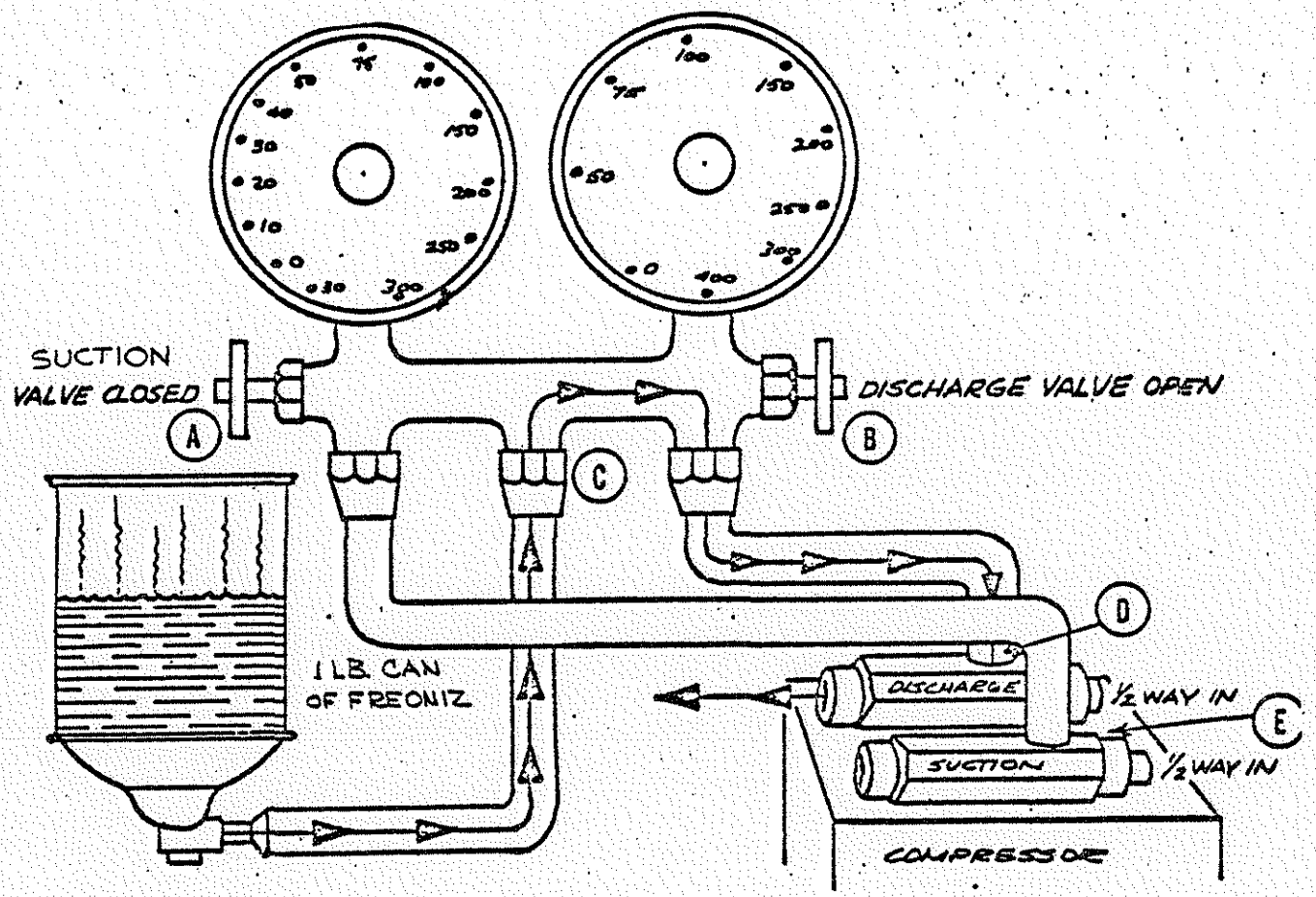
Prior to evacuating the system be certain that it does not contain any Freon. Connect the Service gauges to the Service valves on top of the compressor as illustrated, but do not connect Service gauge manifold's Service hose to the vacuum pump. Close both valves on the Service gauge manifold. Using a ratchet wrench, open both Service valves on the compressor by screwing the square stem on the back of each valve IN two or three turns. Whatever pressure is in the system is now in your service lines as well, so when you open one or both of the valves on the gauge manifold, the Freon will be discharged from the hose in the center of the manifold. DO NOT DISCHARGE TOO FAST because the Freon must be given time to separate from the oil in the system or the oil will be carried out along with it and the compressor will have to be refilled again. When the system is empty, connect the center hose to the vacuum pump as illustrated. Now start the vacuum pump. (Note: it is not necessary to close the Discharge valve, as illustrated, at this point. It is merely a precautionary measure in case you intend to charge the Freon into the system in a GASEOUS STATE, rather than a LIQUID STATE.) As soon as the pump is started, the vacuum gauge should begin to drop and after 3 or 4 minutes your gauge should be indicating 25 to 28 inches of vacuum. If this is not happening check all of the connections, making sure that they are tight. Allow the vacuum pump to operate for about 7 or 8 minutes, then close both valves tightly on the Service gauge manifold and turn off the pump. Observe the reading on the vacuum gauge closely and note its exact amount. If after a period of 10 minutes you have the SAME READING on the gauge, you may be reasonably sure that the system has no leaks in it. Re-open the valves on the Service gauge manifold and turn the vacuum pump on and let it run for at least ONE HOUR.



CHARGING SYSTEM WITH FREON IN GASEOUS STATE

After connecting service gauge manifold to compressor service ports D and E as illustrated, close both valves on Service gauge manifold, A and B. Connect Freon can to service line. Open suction side valve of service gauge manifold and start engine and run fast idle. Be sure that the Freon can is held UPRIGHT at all times to prevent liquid Freon from entering the compressor. When can is empty. close suction valve, A on Service gauge manifold, disconnect Freon can and repeat operation. After system is charged with 3 lbs. of Freon, close suction side of valve of Service gauge manifold, disconnect Freon can and open service valve on top of compressor by turning stem in part way. This will now enable you to get a reading from both gauges while the air conditioner is in operation. To disconnect Service gauge manifold turn stems on compressor's service valves all the way out and disconnect service hoses.

CAUTION — USE EXTREME CARE



WARNING - Never Charge Liquid Freon Into System While Compressor Or Engine Is Running.

CHARGING SYSTEM WITH LIQUID FREON

When the system has been evacuated close both valves on the Service gauge manifold, A and B. Disconnect the vacuum pump and adjust compressor's service valve's stems as illustrated. Connect Freon can, (in the same manner as the gas charging example), then INVERT the can and open the discharge side valve of the gauge manifold. This method can sometimes be rather slow without a complete charging stand and if it does not seem to be progressing rapidly enough, charging may be completed by putting the Freon in as a gas by adjusting the Service gauge manifolds valves and the compressors service, D and E valves to the gas charging position and starting the truck's engine.

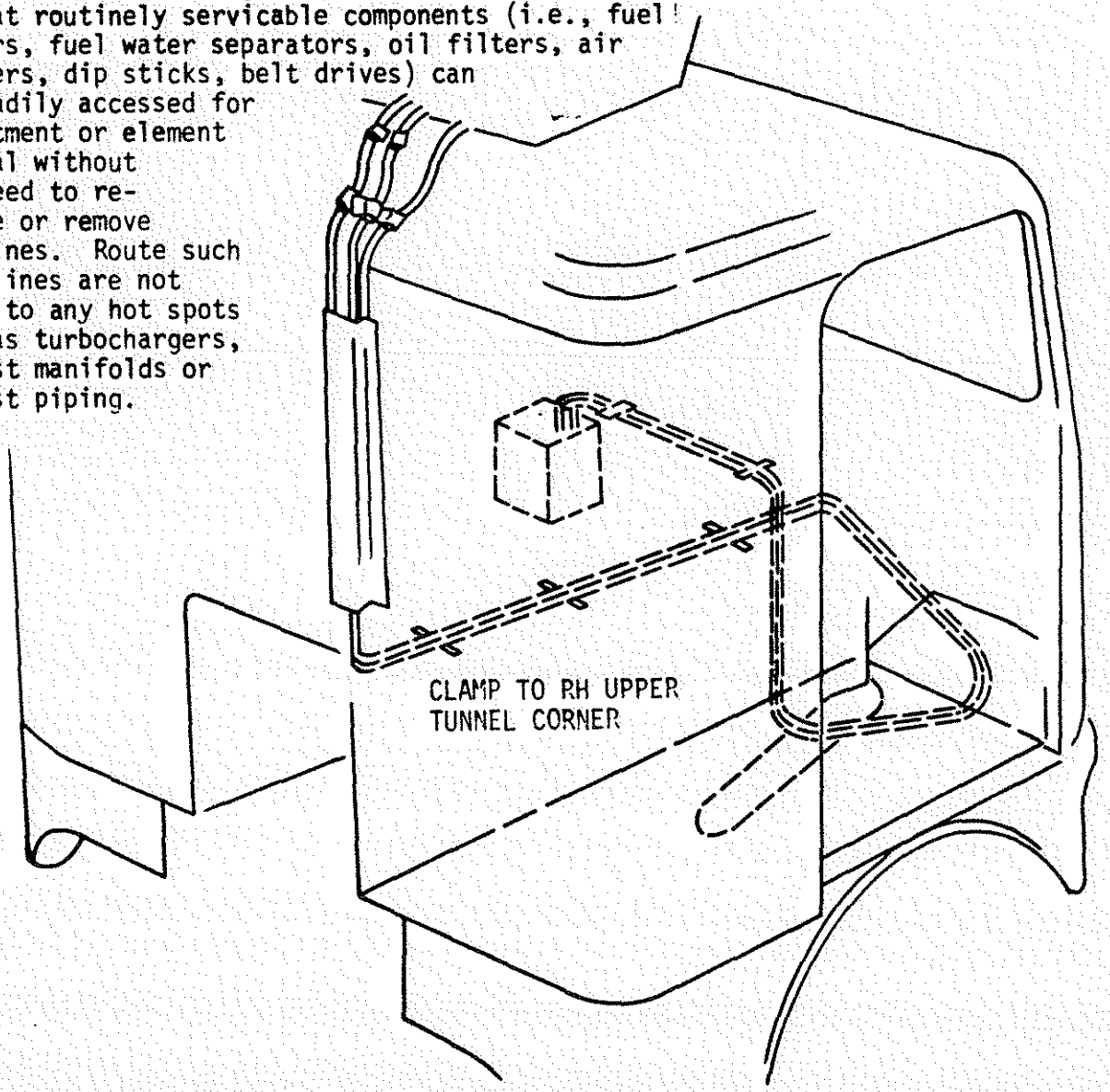
FREON LINES

1. Material: Use only refrigeration type flex hose as specified.

2. Assembly: Use refrigeration oil (not motor oil or grease) to assemble fittings on refrigerant lines. To exclude dirt and prevent entry of moist air into the system, it is imperative to keep lines capped at all times until installed.

3. Clamping: Follow general principles outlined in 33-12101 and especially subtopic #8 "Clamps".

4. Routing: Freon hoses must be routed from roof unit to compressor as shown. (see figure.) All freon lines must be routed so that routinely servicable components (i.e., fuel filters, fuel water separators, oil filters, air cleaners, dip sticks, belt drives) can be readily accessed for adjustment or element removal without the need to re-locate or remove any lines. Route such that lines are not close to any hot spots such as turbochargers, exhaust manifolds or exhaust piping.



CAUTION:

When undertaking to install this air conditioner adhere closely to instructions in literature provided in kits, especially regarding:

1. Slope of roof-mounted unit (for proper drain).
2. Drain hose routing, length and cutting.
3. Any other information pertinent to proper installation.

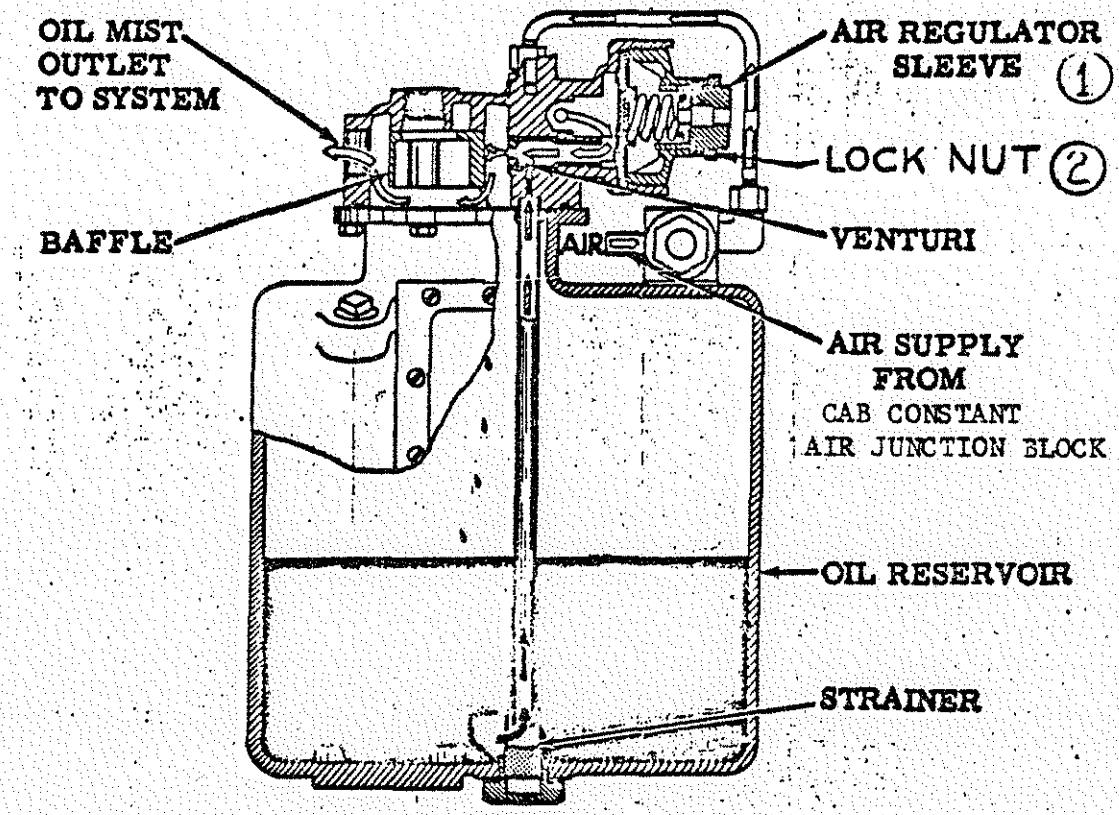
COMPILED	PHILLIPS	SHOP PRACTICE LUBRICATION, OIL MIST SYSTEM	SECTION NUMBER 33-22203
APPRV	PHILLIPS		PAGE 1 OF 1
ISSUE DATE	09/28-65		
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-004 FOR LUBRICATION, OIL MIST SYSTEM PROCEDURE.

INSTALLATION

1. All lines must be free of burrs and foreign matter.
2. C When routing lines, avoid oil traps or dips by pitching all hoses toward the bearings. All lines must be routed so that routinely serviceable components (i.e., fuel filters, fuel water separators, oil filters, air cleaners, dip sticks, belt drives) can be readily accessed for adjustment or element removal without the need to relocate or remove any lines.
3. Anchor oil hoses securely to vehicle so that no rubbing or chaffing can occur.
4. Normal Fitting Usage:
   a. Slotted fittings in all brake cams (slots pointed toward lower or rear quadrant).
   b. -2 fittings (stamped on side of fitting) on all kingpin points.
   c. -1 fittings at remainder of vehicle points.
   d. -3 fittings at suspension cross shaft bushing.
5. Hoses for -2 fittings must come off bottom outlets of the manifold block.
6. Front spring pin lines must come off the lowest outlets in the manifold block.
7. Lines to brake cams must be connected at a point above the lowest point of the manifold block.
8. Manual shut-off valve (for I.C.C. testing) must be installed for operation within the cab. When remote mounting of lubricator is requested, valve must be cab-mounted.
9. Cab mounting of lubricator is preferred so that the ambient temperatures during operation will be between 50° and 100° F. When deviation in lubricator location is necessary, approval must be obtained from Engineerng.
10. Mounting of lubricator on tilt or COE cabs requires the lubricator to be positioned so that mist outlet line points upward when cab is in tilted or open position.
11. Lubricator gage and sight glass should be located where easily visible.
12. Install operating decal at dash area.
13. All bearings and bushings must be flushed with oil (SAE #10) prior to installation of the Oil Mist System.

    Flush brake cam bearings with just two shots of oil from a hand gun to avoid flooding.
14. Install two quarts of oil in unit. Oil Specification: Use non-detergent oil, SAE #10 or 30 API Classified MM Series, as climatic conditions dictate.



CHECK-OUT PROCEDURE - to be done after vehicle's air reaches maximum pressure: (See Figure)

1.

1. Adjust air pressure (1) to indicate maximum 10 psi, and secure locknut (2).

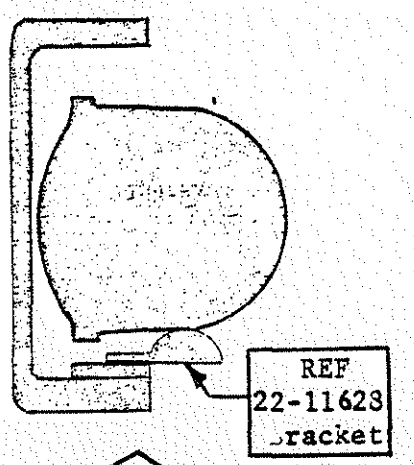
2. Set all lubricators at 10 psi.

3. Using the dash air gage, check that the pressure protection valve in air supply line, required to protect brake air supply, is adjusted to shut off the system on descending air pressure at 75 to 95 psi (pre-set at factory; readjust only if necessary).

4. Check oil level in resevoir (see Item 11 in "Installation" checklist on 22203 Page 1.

Compiled		SHOP PRACTICE	33-22205
Approved		ROAD LAMP INSTALLATIONS, PURLEX	
Issued	2-22-67	Chng Ltr: [illegible] CORPORATION [illegible] OREGON	Page 1
Revised	1-12-68		

1. Purlex Road Lamp Installations on Front Bumper



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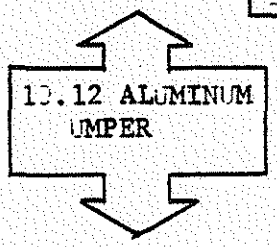

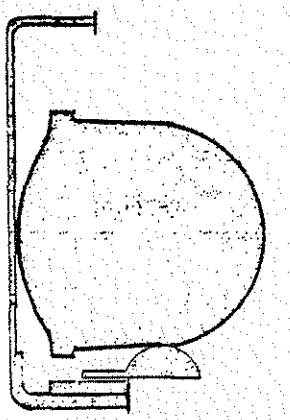

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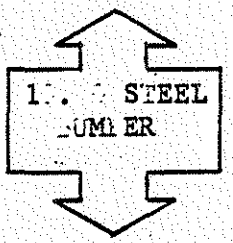

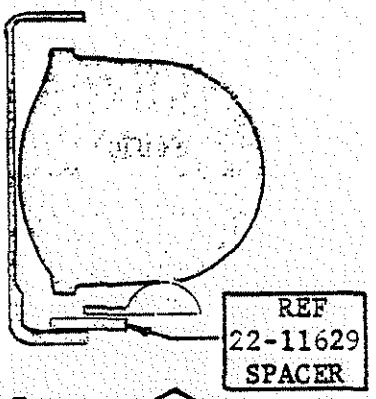

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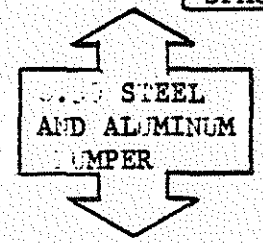

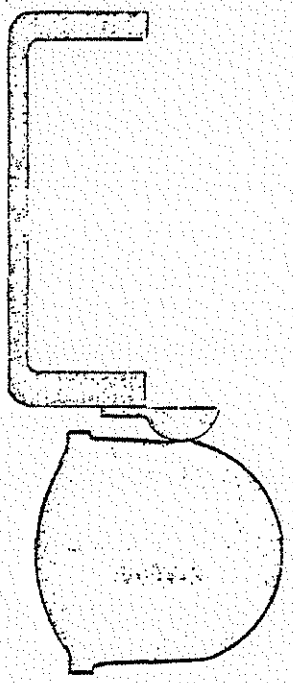

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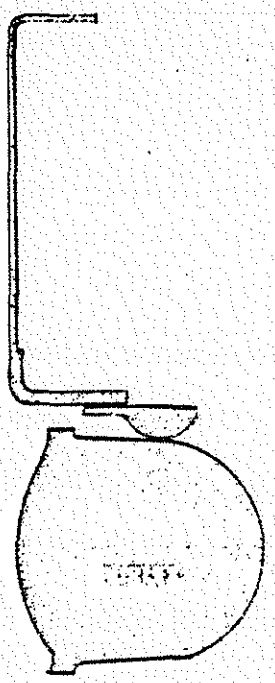

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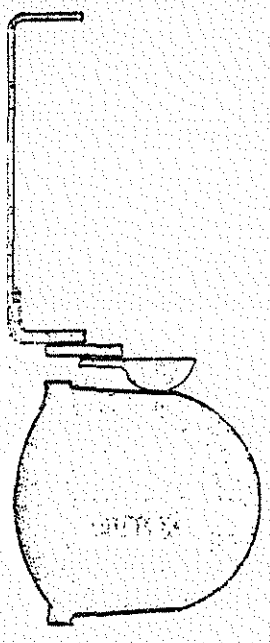
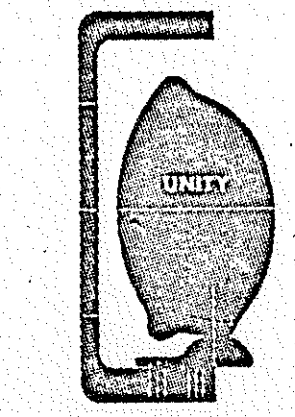


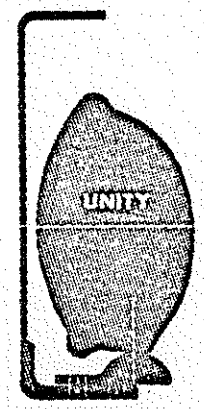
F.

2. Unity Road Lamp Installations on Front Bumper



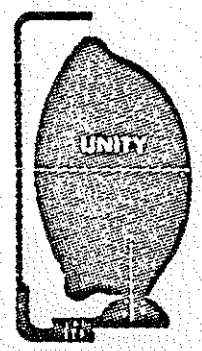
A.

10.12 ALUMINUM BUMPER



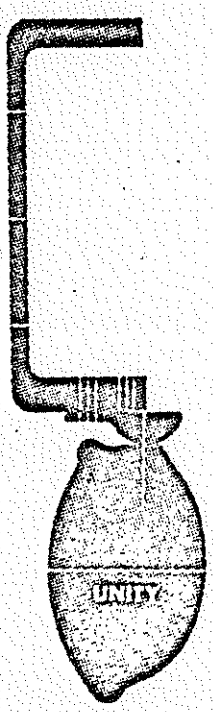
C.

10.00 STEEL BUMPER

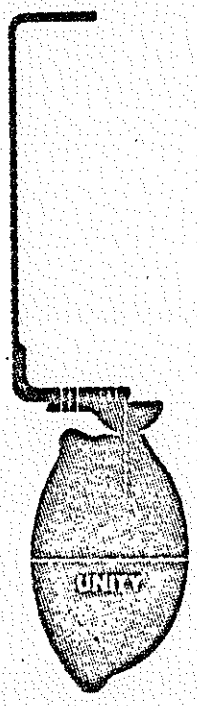


E.

8.50 STEEL AND ALUMINUM BUMPER



B.



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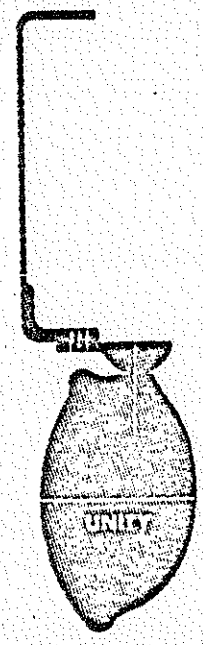


F.

3. Road Light Spacing

Road lights mounted under the bumper are to be spaced 54.50" apart unless denoted otherwise on the chassis specification sheet.

Compiled	J. Skinner	SHOP PRACTICE AIR HORN AND VALVE MOUNTING	33-22206
Approved	DRS		
Issued	11-18-81		
Revised	1-30-84	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	

A 1. Air horns are to be mounted through the roof using standard hex nuts and cap screws with plastic caps placed over the exposed ends of the capscrews on the rearmost mounting pedestals.

2. Plastic caps are to be installed before any sealing compound is applied.

B 3. The horn valve is mounted to the lintel by drilling 2 13/64" diameter holes and securing with 1/4 X 20" self tapping screws.

COMPILED	HEILSON	SHOP PRACTICE WATER FILTER INSTALLATION	SECTION NUMBER 33-22207
APPRV	ROLLINS		
ISSUE DATE	04/08/74		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-005 FOR WATER FILTER INSTALATION PROCEDURE.

1. GENERAL

The water filter unit is more than just a simple filter. It is more accurately termed a "cooling system conditioner" or "corrosion resistor", because the more effective type:

A. Filter out dirt, scale, sludge, and other foreign matter.

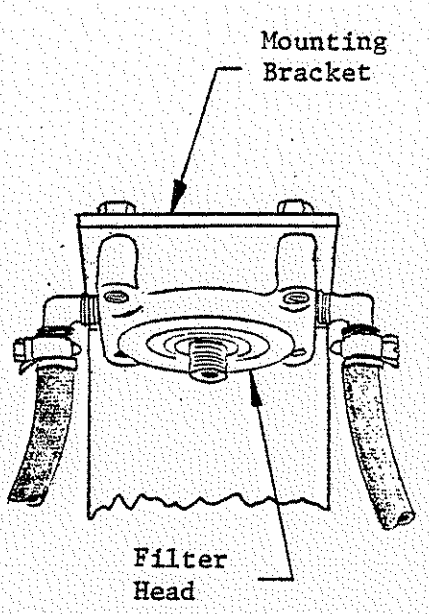
B. Prevent precipitation of scale and sludge even on "hot spots", and

C. Counteract corrosion of metal parts by

(1) Adjustment of acidity by a buffering agent

(2) Reduction of chemical activity by a combination of inhibitors that form and maintain a thin protective coating (which also helps control electrolytic activity)

(3) Control of electrolysis by a sacrificial anode of active metal, such as magnesium, in the "sock" type filters.



2. THE FILTER UNIT

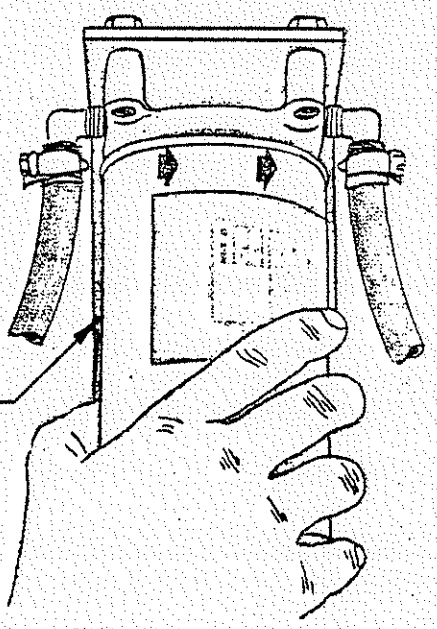
The filter unit consists of:

A. A metal filter head that has both an inlet line and outlet line opening.

B. A spin-on type replaceable filter element containing chemical additives.

(1) When installing the element, hand tighten an additional 1/2 turn after gasket contacts base surface.

(2) Caution: Filter element must comply with compatability listing between engine manufacturers, water filter elements, and cooling system inhibitors and/or anti-freeze per 33-00122.



3. GROUNDING

Since protective action depends on forming an electrical circuit with the parts it protects, by means of a metal path to the part(s) and return through the coolant, proper functioning of the filter device depends largely upon adequately grounding its metal case to the engine.

A. When the filter is engine mounted, moderate care will usually ensure

3. GROUNDING (Continued)

proper metal-to-metal contact, if paint or other insulating substances are absent from the mounting faces.

B. When the filter is frame mounted, one terminal of a #6 ground wire must make good contact on a paint-and-primer-free metal surface under one of the filter mounting bolts with the other terminal similarly grounded to the engine block. Not required with spin on type filters.

B

4. INLET LINES

Inlet lines must be 5/8" inside diameter heater type or #6 wire-braid hose, (unrestricted). Attach to a point on the pressure side of the water pump and keep to a minimum length, usually 18 inches.

5. OUTLET LINES

Outlet lines must be 5/8" inside diameter heater type of #6 wire-braid hose, (unrestricted). Attach to a point on the low pressure or "suction" side of the water pump and may be as long as necessary.

6. SHUT-OFF VALVES

A shutoff valve must be installed in both the inlet and outlet line at the engine to allow coolant flow to the filter to be shut off for servicing the filter element.

7. CHECKING THE INSTALLATION

A. Recheck all connections for tightness and make sure valves are open.

B. If the installation is properly made, the filter casing and hose lines will become increasingly warmer as the coolant temperature rises.

C. If a Flow & Condition Indicator has been installed in the inlet line, check to see that the initial water flow is towards the Filter.

D. Start engine and allow to idle for about ten minutes.

E. Accelerate engine and check all connections for leaks and air locks. If there are air locks, bleed air out of filter and hose assembly by disconnecting the filter outlet line (only momentarily until the coolant escapes) at the engine side.

F. CAUTION: Filter must not be connected in series with any other device (see 4. & 5. above); especially, must be in parallel with air compressor cooling system.

G. All hoses must be routed so that routinely serviceable components (i.e., fuel filters, fuel water separators, oil filters, air cleaners, dip sticks, belt drives) can be readily accessed for adjustment or element removal without the need to relocate or remove any hoses.

8. SELECTION OF POT TYPE REPLACEMENT FILTER ELEMENT:

A. For use with all types (brands) of Ethylene Glycol Antifreeze. (DO NOT USE WITH WATER ONLY)

PAF Element - Perry Filter Division
R.M. Hollingshead Corp.
Camden, New Jersey

B. For use with plain water, with all non-permanent antifreezes, and with compatible permanent antifreezes:

CHROMATE Element - Perry Filter Division
R.M. Hollingshead Corp.
Camden, New Jersey

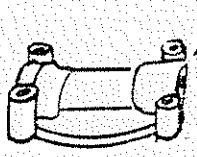
9. SELECTION & INSTALLATION OF SPIN-ON TYPE FILTER ELEMENT

A. Table of Options:

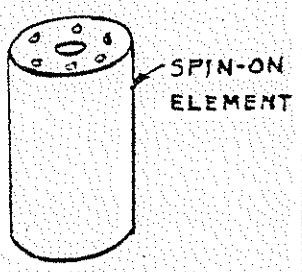
FILTER ELEMENT TYPE	SYSTEM CAPACITY	MANUFACTURER'S NUMBER		ENGINE *
		FLEETGUARD	PERRY	
Borate	All	WF 1011	S-330	DDE
Chromate	Up to 20 gal.	WF 1010	S-320	CUM
	Up to 30 gal.	WF 1012	--	CUM

*Use only with engines listed in this column.

B. When replacing a Fleetguard element with a Perry element, it is not necessary to change the filter head, just replace the filter element.



C. Installation: Install new element, when gasket contacts base surface, turn an additional one-half turn. (Tighten by hand only) Mechanical tightening may distort or crack filter head.



D. Water filter comes installed and plumbed on Cummins engines. For plumbing and inst. on DDE engines see N22-13520. Also note Page 2, Section 4 through 7 of Shop Practice Manual water filter inst.

A Revised & Redrawn

Compiled	RLK	SHOP PRACTICE CAB AIR CONDITIONER INSTALLATION FREIGHTLINER 420A	33-22208
Approved	TRAUB		
Issued	11-6-72	FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1
Revised	6-18-76	Chg Ltr C	

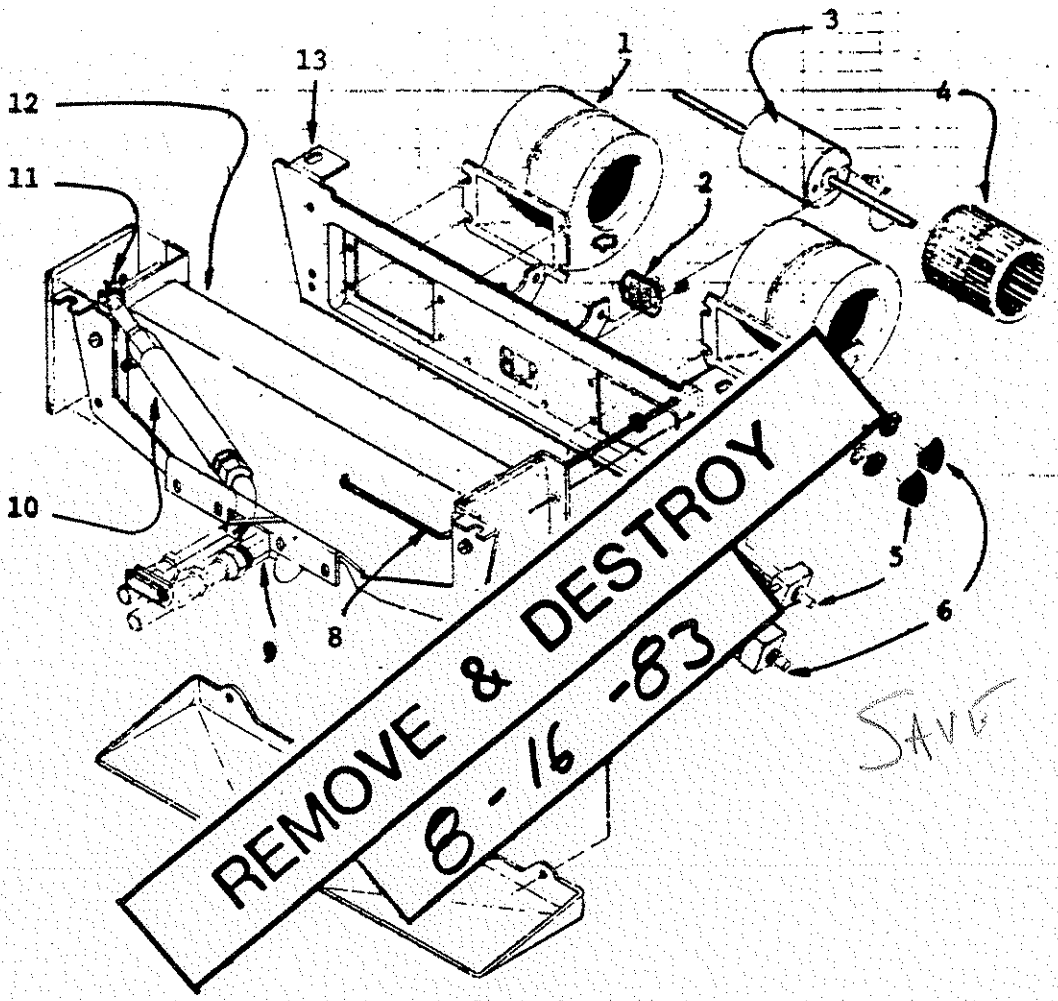


Fig. 1

EXPLODED VIEW OF AIR CONDITIONER

1	Fan Housing	8	Thermostatic Control Sensing Tube
2	Resistor	9	Thermostatic Expansion Valve
3	Blower Motor	10	Suction Throttling Valve
4	Fan Wheel	11	Thermal Bulb
5	Thermostatic Control	12	Evaporator Core
6	Blower Motor Switch	13	Evaporator Frame
7	Drip Pan		

A. DESCRIPTION

1. The air conditioner is a manually controlled vapor-compression system with freon 12 as the working fluid. The Freightliner Model 420A air conditioner has O-ring seals and metal-to-metal shoulder surface contact. The drain hose attaches to the drain plug in the evaporator cover assembly.

(Continued)

(Ref.) For Air Conditioner Kit Assy. (Freightliner Mod 420A) See 33-22222.

REVISED & RETYPED "C" CHG

SAVE

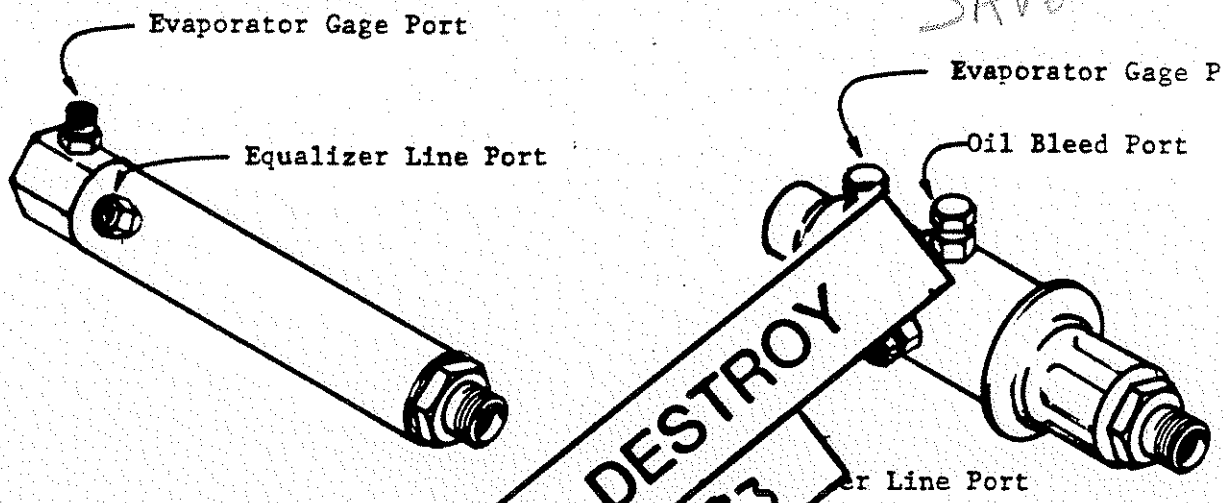


Fig. 2

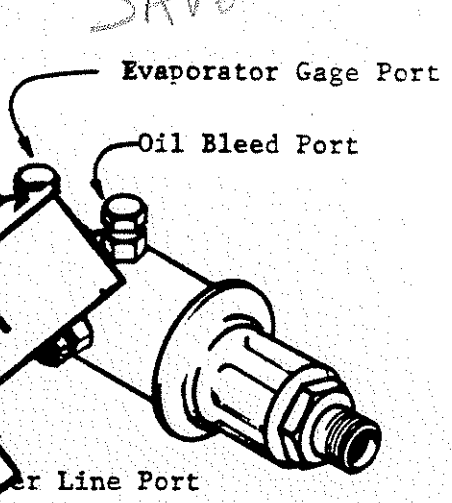


Fig. 3

REMOVE & DESTROY
8-16-83

A. DESCRIPTION (Contin

1. The Model / ottling valve (S.T.V.) in the evaporator coil out of throttling suction valves (S.T.V.) are used pro nt availabilty.

F a. The S.T.V. valve shown in fig. 2 has two ports, one is used for the porator test gage connection and one is used for the equalizing line. The evaporator test gage port is used when testing evaporator pressure, otherwise this port is not used and is protected with a plastic cap.

F b. The Frigidaire S.T.V. valve shown in fig. 3 has three ports. The evaporator gage port is used for evaporator pressure testing as described in (a). The oil bleed part is not used, and must be sealed with 22-14966-000 seal under the cap.

c. The equalizer line port is connected to the tube from the thermostatic expansion valve, see fig. 1 and 6.

The valve is to be replaced if it malfunctions Refer to 33-22222 under section "SUCTION THROTTLING VALVE INSTALLATION AND TESTING".

B. UNIT LOCATION

Locate the cooler unit internally on the cab ceiling using diagrams D22-17216 & D22-14619.

REVISED & RETYPED "D" CHG

C. PRE-INSTALLATION COOLER CHECK

1. Make a pre-installation inspection of the unit, checking the following points especially.

   a. No visible damage nor bent places on the unit working parts, mountings or housings.

   b. The fan motor runs properly and the blower wheels turn freely and truly in their housings.

   c. Evaporator cover assembly, drip pan and [illegible] parts clean and free of drill chips and other foreign part[illegible] might even partly block the drain.

   d. All connecting fittings clean [illegible] or capped until the actual connection is to be made. [illegible] fitting sealing surfaces for any grooves or nicks. R[illegible] parts.

D. PRE-INSTALLATION CHECK OF MO[illegible]

1. Make pre-installat[illegible] mounting site in the cab, covering the following.

   a. Presenc[illegible] ulation in the prescribed places, espe[illegible] ssed in the cab roof above the evaporator fa[illegible]

   b. Al[illegible], piping, etc., which will not be readily accessible after inst[illegible]tion is properly routed, protected and secured in place.

   c. All connecting piping is throughly clean and free of any dirt or moisture.

E. EVAPORATOR INSTALLATION IN CEILING LOCATION

1. WARNING: Care should be taken to prevent refrigerant from contacting the skin or eyes because liquid refrigerant-12, at normal atmospheric pressure and temperature, evaporates and will tend to freeze anything that it contacts. Goggles and gloves should be worn while charging or discharging the system.

   a. Apply refrigeration oil to O-rings, and threads at the fittings.

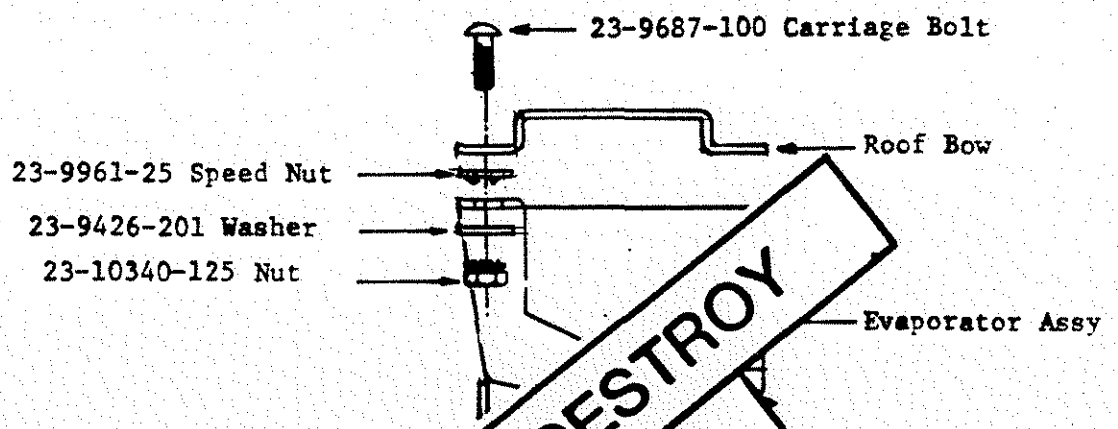
   b. Remove plugs from hoses. Connect refrigerant hoses to thermostatic expansion valve, and suction throttling valve. Carefully align fittings to avoid cutting the O-rings. Use two wrenches when tightening fittings to prevent twisting of tubing. Tighten connections to the torque value given in Table 1 under "SPECIFICATIONS" in this section. Wrap the #8 freon fitting with black insulation tape (Ref. 48-02189) to prevent "sweating".

(Continued)

REMOVE & DESTROY 8-16-83

REVISED & RETYPED "C" CHG

SAVE



REMOVE & DESTROY 8-16-83

E. EVAPORATOR INSTALLA[illegible]ON (Continued)

c. Secure[illegible]tling valve hose and thermostatic expansion valv[illegible]porator frame.

d. [illegible] to bu[illegible].

e. Evap[illegible]tor mounting (See Fig. 4)

(1) Drop carriage bolt through slot in cooler roof bow.

(2) Thread on flat speed nut by hand to prevent carriage bolt from backing up against roof skin.

(3) Push evaporator frame assembly up to bows with capscrew extended through frame slots. Push the evaporator assembly forward until the evaporator defroster fan bracket portion of the frame contacts the air plenum.

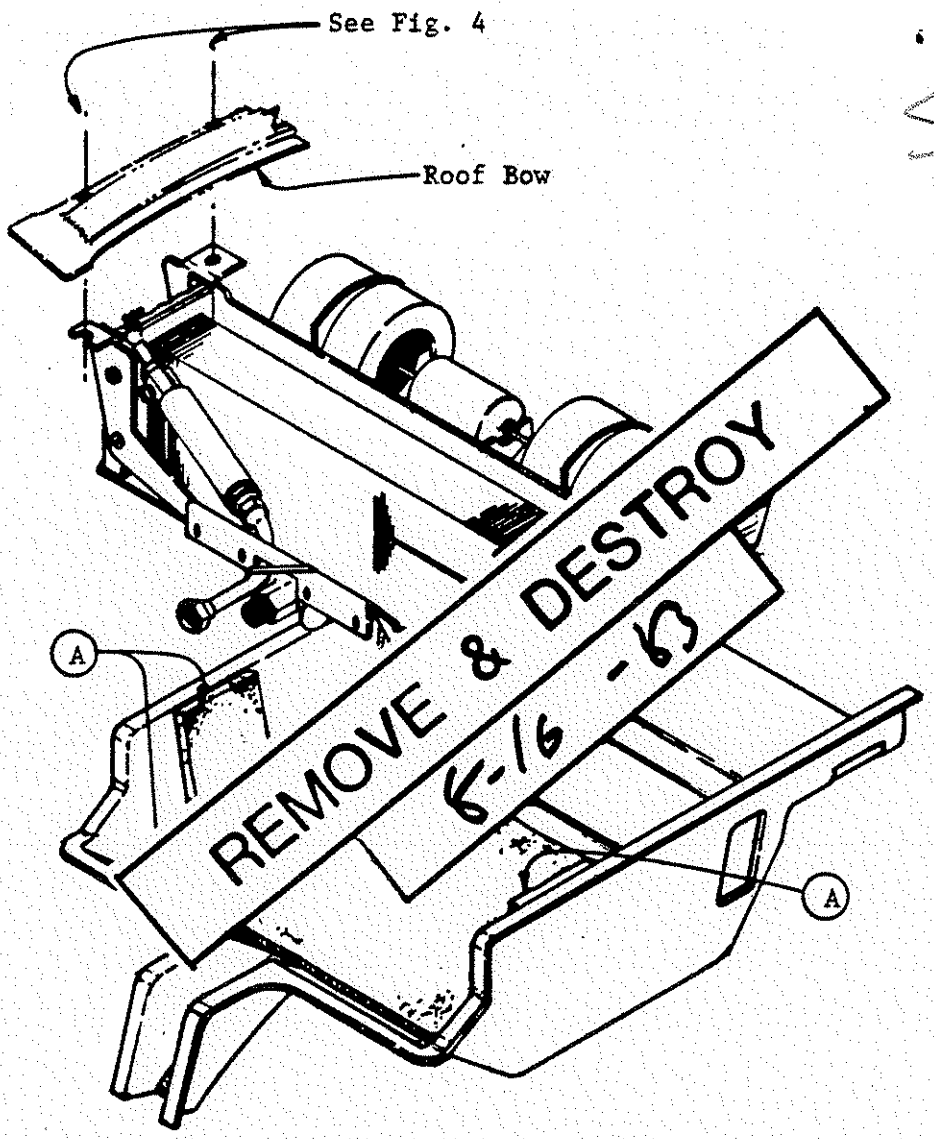
(4) Add fender washer, lockwasher and nut. Tighten the lock nut to 6 ft-lbs.

f. Connect the electrical wires using the wiring diagram under "SPECIFICATIONS". Check that the resistor coil on the switch is fully in the air stream.

g. Connect drain hose to cover assembly. The drain hose must slope downward in an even arc for its full length. Be sure the end under the deck is open and cut off at a 45° angle with the longer portion toward the front for scavenging effect.

(Continued)

REVISED & RETYPED "D" CHG



SAVE

Fig. 5

E. EVAPORATOR INSTALLATION IN CEILING LOCATION (Continued)

h. Be sure that the foam seals and surge baffle (A in Fig. 5) are securl -ey glued in place. (Ref. A22-14607)

i. Evacuate, charge, and leak test the system using the procedures given under "EVACUATING, CHARGING, AND LEAK TESTING" 33-22227.

j. After the system has been evacuated, charged, and leak tested, install the evaporator cover.

k. Be sure freon line installation conforms with clamping and routing instructions of 33-22215.

B REVISED & RETYPED "A" CHG

F. CONDENSER COIL INSTALLATION

1. Remove the plug from the receiver-drier line, apply refrigerant oil to seal surfaces, O-rings and threads. Connect receiver-drier line to condenser coil. Tighten the connection to the torque value given in Table 1 under "SPECIFICATION B"

2. Remove plug from the compressor line, apply refrigerant oil to seal surface surfaces, O-rings and threads. Connect compressor line to condenser coil. Tighten the connection to the torque value given in Table 1 under "SPECIFICATIONS".

G. RECEIVER DRIER INSTALLATION

SAVE

1. Position the receiver-drier in the m[illegible]et, and install U-bolts, washers and nuts attaching receiv[illegible]ounting bracket. Tighten U-bolt nuts to 13 ft-lbs. torque [illegible]o not remove protection caps from the receiver-drier unti[illegible]o connect to the system. Leaving the reciever dryer [illegible]o malfunction, and it will have to be replaced.

2. Remove the plugs fr[illegible]e and condenser line. Apply refrigeration oil [illegible]threads, then connect the lines to the receiver-d[illegible]hes to avoid twisting the tubing, tighten the [illegible]rque value given in Table 1 under "SPECIFIC[illegible]

REMOVE & DESTROY 8-16-83

H. SPECIFICA[illegible]

TABLE 1. [illegible]rigerant Line Torque

O.D. OF METAL TUBE, INCHES	*TORQUE FOR STEEL TUBES FT-LB	*TORQUE FOR ALUM. OR COPPER TUBES FT-LB
1/4	10 - 15	5 - 7
3/8	30 - 35	11 - 13
1/2	30 - 35	15 - 20
5/8	30 - 35	21 - 27
3/4	30 - 35	28 - 33

*When tightening fittings, always use the torque reading for the softer metal when unlike metals are used.

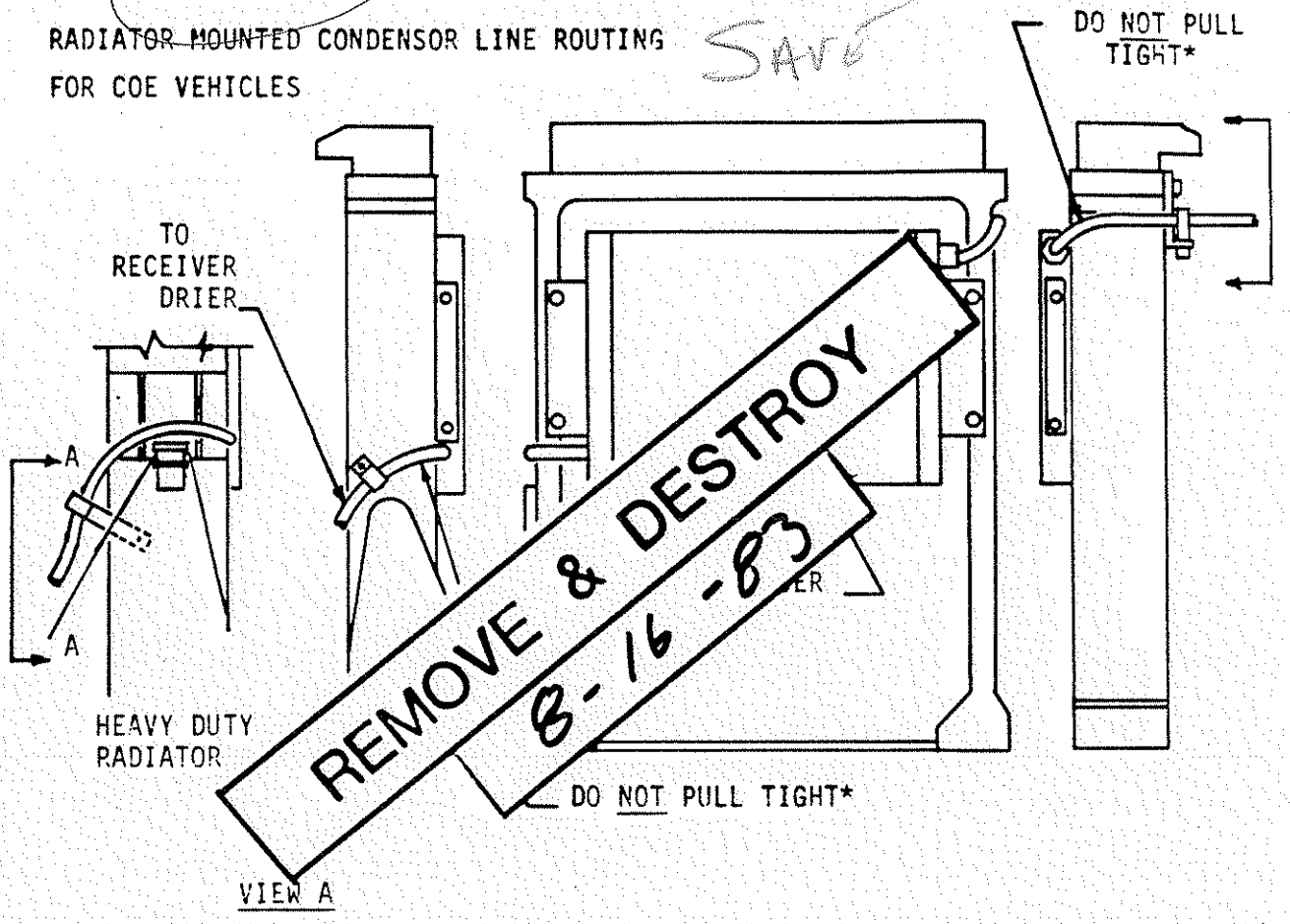
1. For proper sealing, all refrigerant lines should be tightened as shown in table 1. These torque values need only be checked on an audit basis.

C

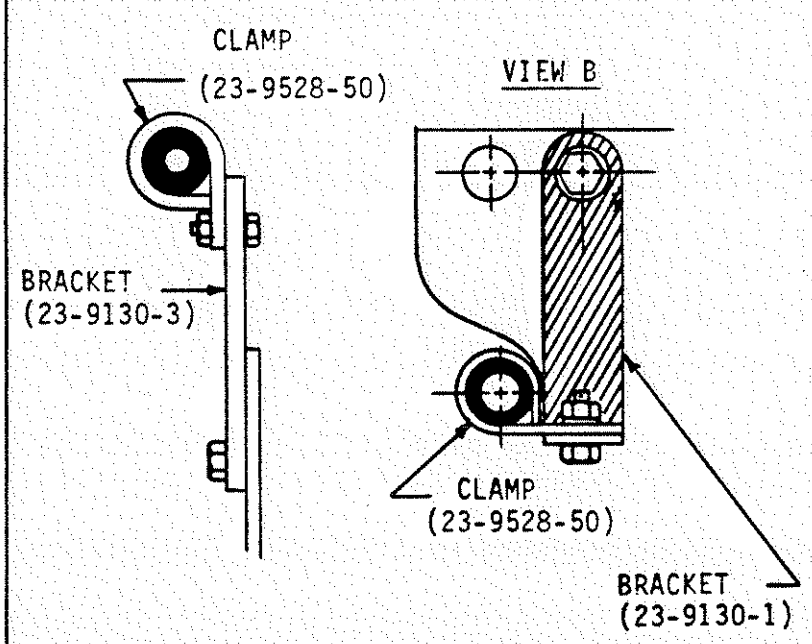
REVISED & RETYPED "A" CHG

Compiled	H. DANG	SHOP PRACTICE	33-22208
Approved	RHH	AIR CONDITIONER INSTALLATION	
Issued	11-27-78	RADIATOR MOUNTED CONDENSER	
Revised	1-26-83 Chg Ltr A	FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 6.1

RADIATOR MOUNTED CONDENSOR LINE ROUTING SAVE
FOR COE VEHICLES



VIEW A



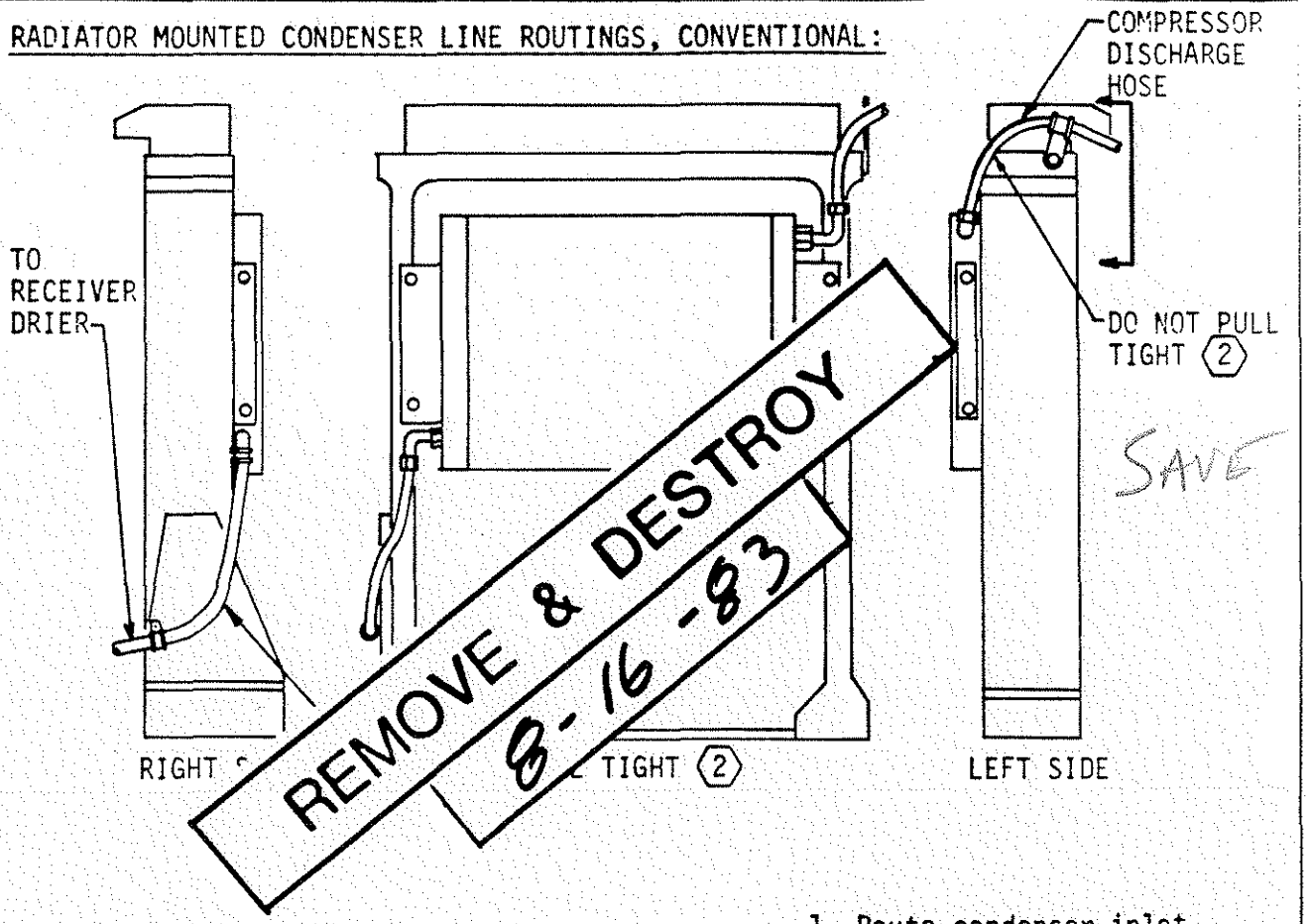
NOTE: ROUTE CONDENSER INLET (OR COMPRESSOR DISCHARGE) LINE UNDER LIP OF LEFT HAND RADIATOR SIDE CHANNEL AND SECURE TO THE SIDE CHANNEL WITH CLAMP AND BRACKET AS SHOWN.

* PULLING OF THE HOSES BEFORE SECURING CAN DAMAGE THE CONDENSER FITTINGS.

Compiled	S. Baroudi	SHOP PRACTICE AIR CONDITIONER INSTALLATION RADIATOR MOUNTED CONDENSER	33-22208
Approved			
Issued	11-18-81		
Revised		Chg Ltr	PAGE 6.2

FREIGHTLINER CORPORATION
PORTLAND, OREGON

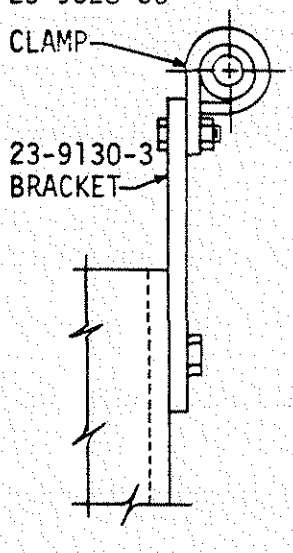
RADIATOR MOUNTED CONDENSER LINE ROUTINGS, CONVENTIONAL:



REMOVE & DESTROY
8-16-83

SAVE

VIEW "A"



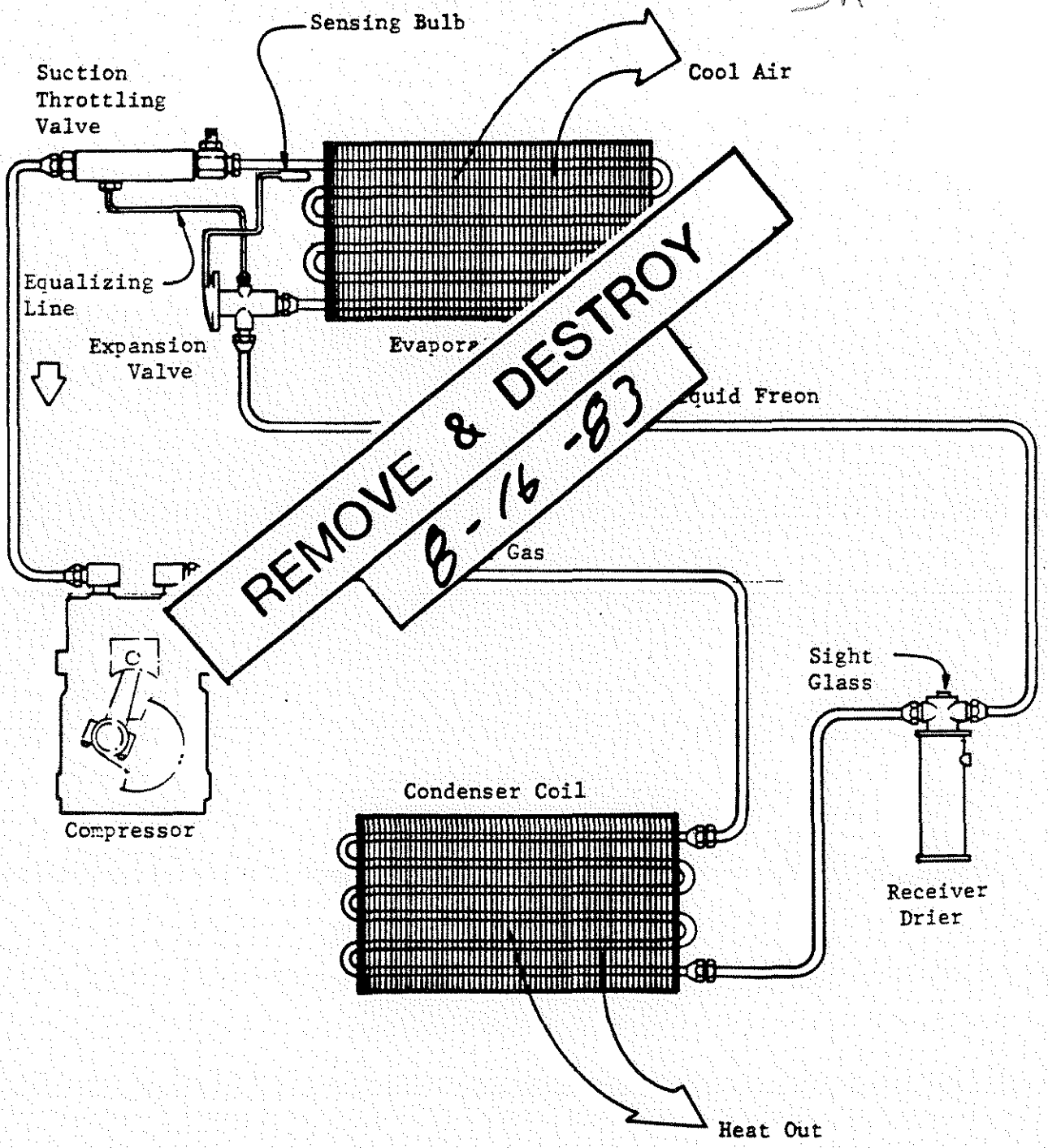
1. Route condenser inlet (compressor discharge) line to the radiator side channel or mtg. bracket and secure with Freon hoses - slack.

(2) Pulling the Freon hoses before securing can cause failure of the condenser fittings.

B

REFRIGERANT FLOW DIAGRAM

SAVE



REMOVE & DESTROY 8-16-83

Fig. 6

REVISED & RETYPED "A" CHG

SAVE

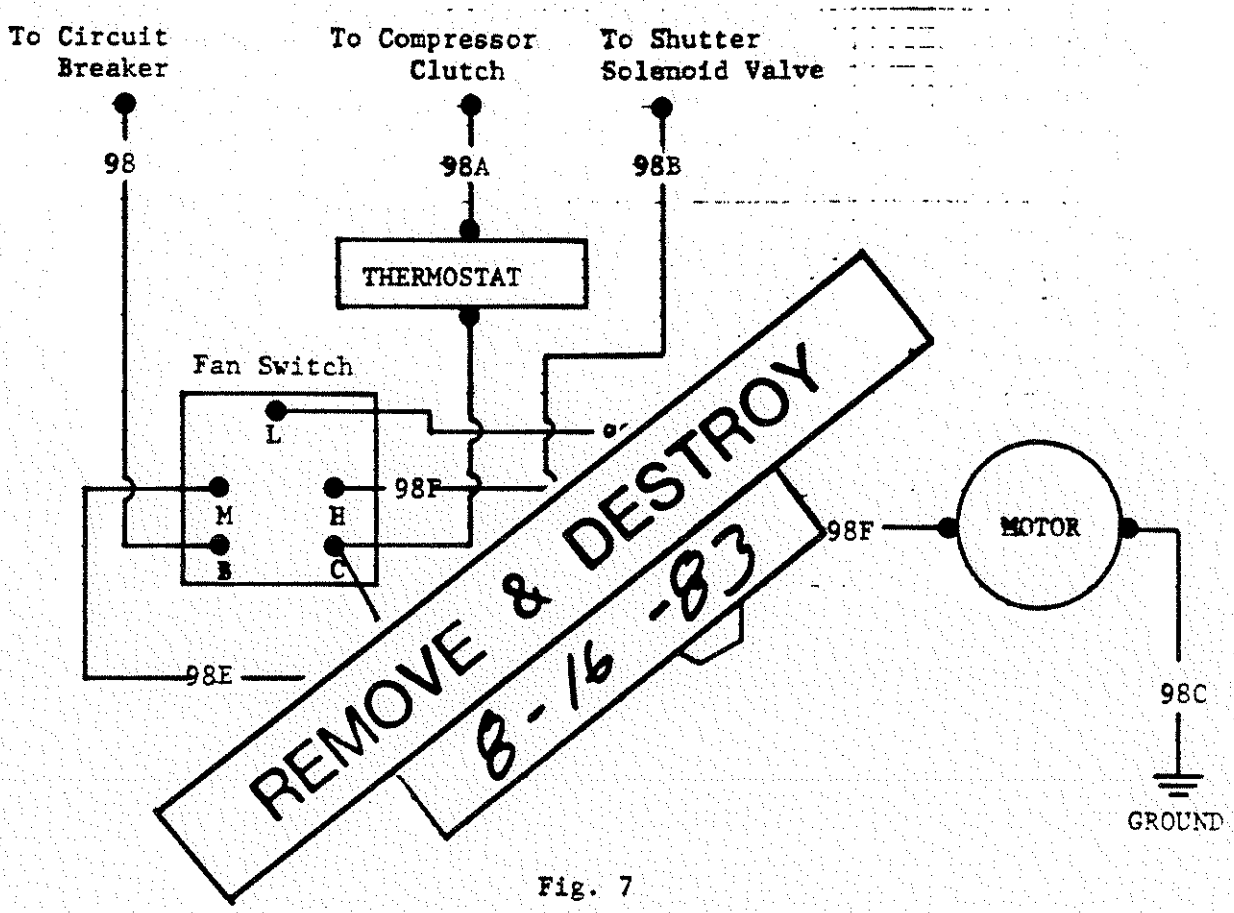


Fig. 7

AIRCONDITIONER (MOD 420A) WIRING DIAGRAM
(NEGATIVE GROUND SYSTEM SHOWN)

NOTE: Connect orange wire (98F) to ground for POSITIVE ground system. Connect black wire (98C) to ground for NEGATIVE ground system.

REVISED & RETYPED "A" CHG

TROUBLE SHOOTING

SAVE

PROBLEM	POSSIBLE CAUSE	CORRECTION
Blower Motor Not Operating	a. Circuit breaker open due to short.	Locate and repair short
	b. Defective blower motor	Replace switch
	c. Loose connector or broken wire in air conditioner circuit.	Repair
	d. Defective resistor	
	e. Defective motor	ace
Blower Motor Operating but Low or No Air Flow	a. Blower whee… motor sh…	…ter blower wheel in cage and …ten set screws.
	b. Blo… h…	Remove blower wheel(s) and remount to motor shaft so that the Hub(s) face toward the passenger (R.H.) side of the vehicle. The hub of the blower wheel being that portion containing the set screw.
	Blow… motor turning backwards	Reverse blo…er motor leads (See Fig.1 for correct rotation and Fig.7 for wiring diagram.)
	d. Restricted air duct	Remove restriction
	e. Ice blocking evaporator	Replace valve (Expansion)
	f. Low evaporator pressure	Replace valve (Expansion)
	g. Defective suction throttling valve	Replace valve
	h. Air leaks in system	Locate and repair leaks.
Full Air Flow but No Cooling (that is, Evaporator not Cold)	Moisture in system, Receiver-Drier defective	Replace drier

REMOVE & DESTROY 8-16-83

REVISED & RETYPED "A" CHG

TROUBLE SHOOTING (Continued)

SAVE

PROBLEM		POSSIBLE CAUSE	CORRECTION
High Evaporator Discharge Air Temperature			
	With Foaming in Sight Glass	a. System low on refrigerant	Add refrigerant.
A		b. Leaks in freon system	...aks. (See 33-22227 ...esting".)
		c. Restriction in ... between cond... sight gla...	...ove restriction in line.
	Without Foaming	System ... press... not...	...vacuate, charge, and leak test the system. See section titled "Evacuating, Charging, and Leak Testing". (33-22227)
	With Low F... orator ... Outle...	...n throttling valve inlet line warm, restriction in line showing frost spots.	Remove restriction or replace line.
		b. Plugged inlet screen in thermostatic expansion valve.	Clean screen in thermostatic expansion valve.
		c. Defective thermostatic expansion valve.	Replace thermostatic expansion valve.
		d. Restrictions in liquid line to thermostatic expansion valve.	Remove line restrictions.
		e. Ice blocked evaporator.	Allow system to warm up with compressor stopped.
		f. Defective suction throttling valve.	Replace suction throttling valve.
		g. Equalizer line to thermostatic expansion valve kinked.	Replace thermostatic expansion valve and equalizer line assembly if kinked or flattened.

REMOVE & DESTROY 8-16-83

TROUBLE SHOOTING (Continued)

SAVE

PROBLEM	POSSIBLE CAUSE	CORRECTION
A High Compressor Discharge Pressure	a. Shutter not opening.	Adjust or repair shutters. Replace shutter solenoid valve. See Wiring Diagram.
	b. Condenser air flow restricted.	Remove restriction of air flow through condenser.
	c. Refrigerant restriction in condenser. Refrigerant tube bends show same temperature	Clean condenser.
	d. Air in system.	Repair leaks in system. See "Leak Testing" 33-22227.
High Evaporator Discharge Pressure	Thermostatic bulb not in contact with tube.	Clean tube and secure bulb to tube.
Equalizer Line Hot or Cold	Suction throttling valve not operating due to moisture freezing piston.	Allow system to warm up. Restart engine, check evaporator outlet pressure. If still low replace suction throttling valve.
Equalizer Line Warm	a. Clutch or belt slipping.	Clean clutch facing. Adjust belt tension.
	b. Suction line restricted.	Remove restriction(s).
	c. Compressor in need of repair.	Repair or replace compressor.
A Evaporator Outlet Air Temperature Drops as Compressor Discharge Pressure Drops	Leaks in system.	Repair leaks. (See "Leak Testing" 33-22227).
Evaporator Outlet Air Temperature Increases as Compressor Discharge Pressure Drops	Thermostatic expansion valve setting is low.	Replace thermostatic expansion valve.

REMOVE & DESTROY 8-16-83

TROUBLE SHOOTING (Continued)

SAVE

PROBLEM	POSSIBLE CAUSE	CORRECTION
Temperatrue in Cab Too High with Normal Evaporator and Discharge Pressure	a. Heater water shutoff valve not closed.	Close heater water valve.
	b. Air door to heater not closed (temperature door).	Close heater air door and make sure cable linkage is free from binding and is engaging f[illegible] travel.
	c. Seal leakage, evaporat[illegible] to-cover.	[illegible]over to evaporator.
	d. Heater shutoff do[illegible] sealing.	[illegible]eal heater door.
Cab Will Not Cool Down 15° F. In 5 Minutes.	a. Fresh air	[illegible]ove Htr. lever for "Air [illegible]de To Off".
	b. He[illegible]	Switch off WK-30 and/or aux. Htr.
		Close windows & air vents in doors & sleeper compt.
	Lo[illegible]e speed	Engine speed to be at least 1500 RPM.
	e. A/C Fans on low	Set fans on high & thermo. on cold.
Evaporator Outlet Air Temperatrue Increases as Compressor Discharge Pressure Drops	a. Excessive oil in system. An indication of this is clutch slippage or belt slippage at governed engine speed.	Set controls at high blower and maximum cold, operate engine at idle for ten minutes. Discharge system and drain excess oil from compressor. Evacuate, charge and leak test system.
	b. Excessive oil in thermostatic expansion valve and suction throttling valve.	Remove thermostatic expansion valve and suction throttling valve. Drain oil from valves and flush the remaining components with R-11 flushing fluid or equivalent to remove any remaining oil. Reinstall valves. Refill compressor with new oil. Evacuate, charge and leak test system. (See 33-22227)

REMOVE & DESTROY 6-16-83

REVISED & RETYPED "A" CHG

Compiled	F. FREER	SHOP PRACTICE	33-22209
Approved	D. Lutzenkirchen	ACCESSORIES: TORQUING OF SCREW FASTENERS	
Issued	12/15/65		
Revised	6-16-83	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	

B ↓

SPECIAL VALUES: For the fasteners listed use the indicated torque values rather than the table below.

FASTENER	THREAD SIZE	GRADE BOLT MAT'L	TORQUE	REMARKS
Mounting Bolt, Kysor Air Conditioner	3/8-24UNF X 3-1/2	5	4-6 FT-LB	Torque from inside cab
Nut, Coupling, Flexible Shaft (Stewart-Warner):				
Instrument End	5/8-18 NS	-	50± 5 INCH-LB	Upper Nut & Ferrule SW #95114
Take-Off End	7/8-18 NS	-	100± 10 INCH-LB	Lower Nut SW #78620

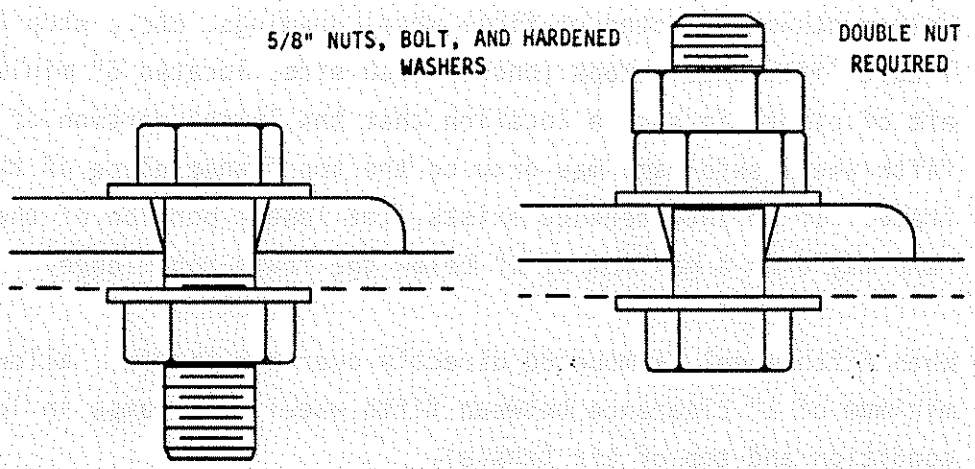
GENERAL VALUES: Not for the fasteners shown above.

	GRADE 5	GRADE 8 / 8.2
DIA-THD	TORQUE lbf·ft (N·m)	TORQUE lbf·ft (N·m)
1/4-20 1/4-28	5-7 (7-9) 6-8 (8-11)	7-10 (9-14) 10-13 (14-18)
5/16-18 5/16-24	11-15 (15-20) 13-17 (18-23)	16-20 (22-27) 18-22 (24-30)
3/8-16 3/8-24	20-25 (27-34) 25-30 (34-41)	35-40 (47-54) 40-45 (54-61)
7/16-14 7/16-20	35-45 (47-61) 40-50 (54-68)	55-65 (75-88) 60-70 (81-95)
1/2-13 1/2-20	55-65 (75-88) 65-75 (88-102)	80-90 (108-122) 90-100 (122-136)
9/16-12 9/16-18	80-90 (108-122) 90-100 (122-136)	110-125 (149-170) 125-140 (170-190)
5/8-11 5/8-18	110-125 (149-170) 130-145 (176-197)	170-185 (231-251) 185-200 (251-271)
3/4-10 3/4-16	200-220 (271-298) 220-240 (298-325)	275-300 (373-407) 320-345 (434-468)
7/8-9 7/8-14	320-345 (434-468) 360-385 (488-522)	460-485 (624-658) 500-525 (678-712)
1-8 1-12 1-14	480-505 (651-685) 530-555 (719-753) 540-565 (732-766)	680-710 (922-963) 740-770 (1003-1044) 760-790 (1031-1071)
1-1/8-7 1-1/8-12	600-630 (814-854) 660-690 (895-936)	960-1000 (1302-1356) 1080-1120 (1464-1519)
1-1/4-7 1-1/4-12	840-880 (1139-1193) 920-1040 (1248-1410)	1370-1420 (1858-1926) 1520-1570 (2061-2129)

COMPILED	HERZIG	SHOP PRACTICE FIFTH WHEEL MOUNTING & STOP INSTALLATION	SECTION NUMBER 33-22211
APPRV	D WELKER		
ISSUE DATE	07/19/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	D		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-006 FOR FIFTH WHEEL MOUNTING AND STOP INSTALLATION PROCEDURE.

PREFERRED OPTIONAL (AS REQ'D)



A. STATIONARY & SLIDING

1. All fifth wheel attaching hardware, including those for frame attachment of mounting angles, are to be Grade 8 UNC capscrews, Grade C UNC nuts and hardened washers.

2. For vertical fasteners, preferred method is to assemble fasteners with bolt head up unless fastener assembly cannot be torqued from nut end. Assembly must be double nutted when nut is located up.

3. Fifth wheel and slide furnished as an assembly by one manufacturer: Do not remove or replace fifth wheel manufacturer's fasteners used to attach fifth wheel to slide plate.

B. FIFTH WHEEL SKID RAMP STOP INSTALLATION

Stationary and Sliding Fifth Wheels

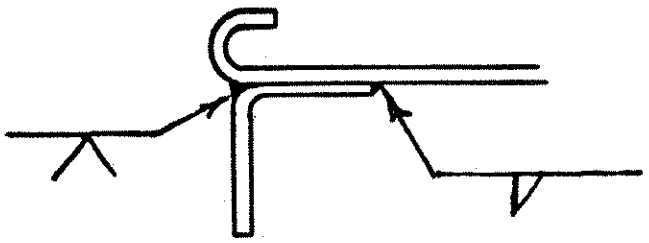
1. Unless otherwise noted on fifth wheel drawings, etc., shop will locate fifth wheel stops (one on each side, located 5" minimum aft of pivot) in such a location that the lowest portion of the fifth wheel skid ramp may drop to the top flange plane of the frame. If no interference exists, the lowest portion of the skid ramp may drop a maximum of 1" below the frame top flange.

2. When fifth wheel is mounted directly over air tank(s), allow minimum of 1" clearance between fifth wheel skid ramps in lowest condition and top of air tank(s).

C. FIFTH WHEEL WELDING C

1. Weld area must be clean, free of oil, paint and scale.

2. See welding diagrams for size, location and length of weld.

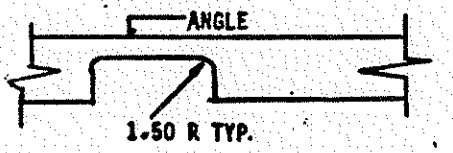


NOTE: Tolerance on welds between fifth wheel and mounting angles is $^{+\ .5}_{-\ .0}$ inch on their length and ± .5 inch on their centers

D. FIFTH WHEEL MOUNTED ANGLE BRACKETS

1. Fifth wheel mounted angle brackets must mount snug to frame flange. Maximum gap between mounting angle and top of frame rail must not exceed .06 inch (1.5 mm) without the prior approval of Engineering.

2. All angles requiring cutouts for clearance (purposes) must have a minimum 1.50" radius TYP and must be ground smooth.



E. FIFTH WHEEL CHECKING

1. Before the vehicle is released, the fifth wheel must be tested in the static fixture as described below:

   a) Lock the trailer pin on the fixture into the vehicle fifth wheel. Check that the fifth wheel mechanism has fully engaged the pin by driving slowly forward until the driving wheels slip.

   b) For Sliding Fifth Wheels: Unlock the slide and check that the fifth wheel will move the full extent from the rear stop to the front stop. Lock the sliding mechanism and check that it is securely engaged by driving slowly forward until the driving wheels slip.

   When the wheel has passed this inspection procedure, stamp 1/2" high letter "C" on the fifth wheel flange close to the release handle.

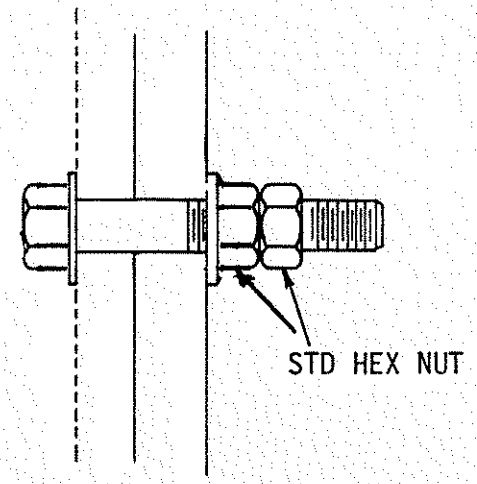
COMPILED	D. WELKER	SHOP PRACTICE TOW HITCH & TOWING CROSSMEMBER INSTALLATION	SECTION NUMBER 33-22212
APPRV	D. WELKER		
ISSUE DATE	12/06/71		PAGE 1 OF 1
REV. DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG. LTR	D		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-007 FOR TOW HITCH AND TOWING CROSSMEMBER INSTALLATION PROCEDURE.

Compiled	D.Welker	SHOP PRACTICE TOW HITCH & TOWING CROSSMEMBER INSTALLATION	33-22212 PAGE 1
Approved			
Issued	12-6-71		
Revised	04/26/89	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2006-34

1. Tow Hitch

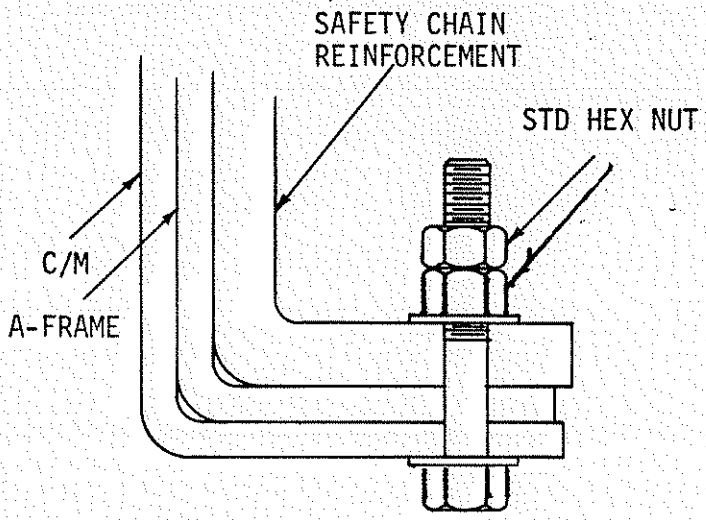
All tow and hostler hitch mounting fasteners must be **double** nutted as shown below.



2. Towing Crossmember

All vertically installed fasteners, which fasten any part of towing crossmember, A-frame, channel arms, safety chain reinforcement or gussets, shall be installed with the bolt head in the up position whenever possible.

If the fastener must be installed with the bolt head in down position, the nut must be backed up with a standard hex nut as shown below.



Compiled	F. FREER	SHOP PRACTICE AIR WINDOW INSTALLATION ARISTO-AIRE	33-22213
Approved	B KOEPKE		
Issued	4/20/67		
Revised	11-21-79	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	

TROUBLE SHOOTING

1. Window will not move down with air pressure.

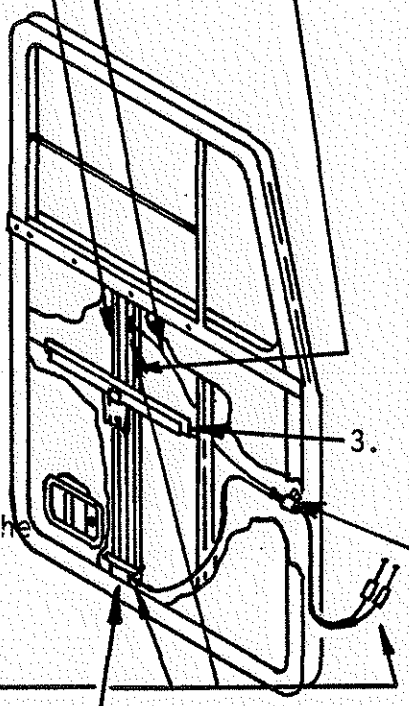
   a. Check twin plastic hose (due to heat, wear from friction, drilling or pinched area).
   b. Check back of air tube for hole drilled in air chamber.
   c. In sequence: push up button. This should release the brake.

   d. Make sure all hoses are pushed completely into their fittings until they meet the internal stops. To release, push down the collet around the end of the tube and pull on the tube.

   e. Check end plugs for leaks by depressing valve(s) and holding. Tighten (2) screws.
   f. Tape seal leak. (See "how it works"). Locate leak with air pressure in tube. Exhaust air. Insert thin ½" wide strip of stiff plastic between tube and tape to dislodge foreign object. May require several attempts.

2. Glass Drifting Down

   a. Piston arm not engaged with glass channel slot.
   b. Piston arm is broken.
   c. Brake mechanism mal-function. If piston arm can be pushed down with glass channel and piston arm engaged properly...return to Aristo-Aire for warranty per instructions.



3. Binding

   a. Check glass channel location should be centered on glass. Disengage piston arm from glass channel before making any adjustments.

GROMMET

NOTE: If the truck air is depleted the glass can be raised by placing hands on each side of glass and pushing up.

REFRIGERANT FLOW DIAGRAM

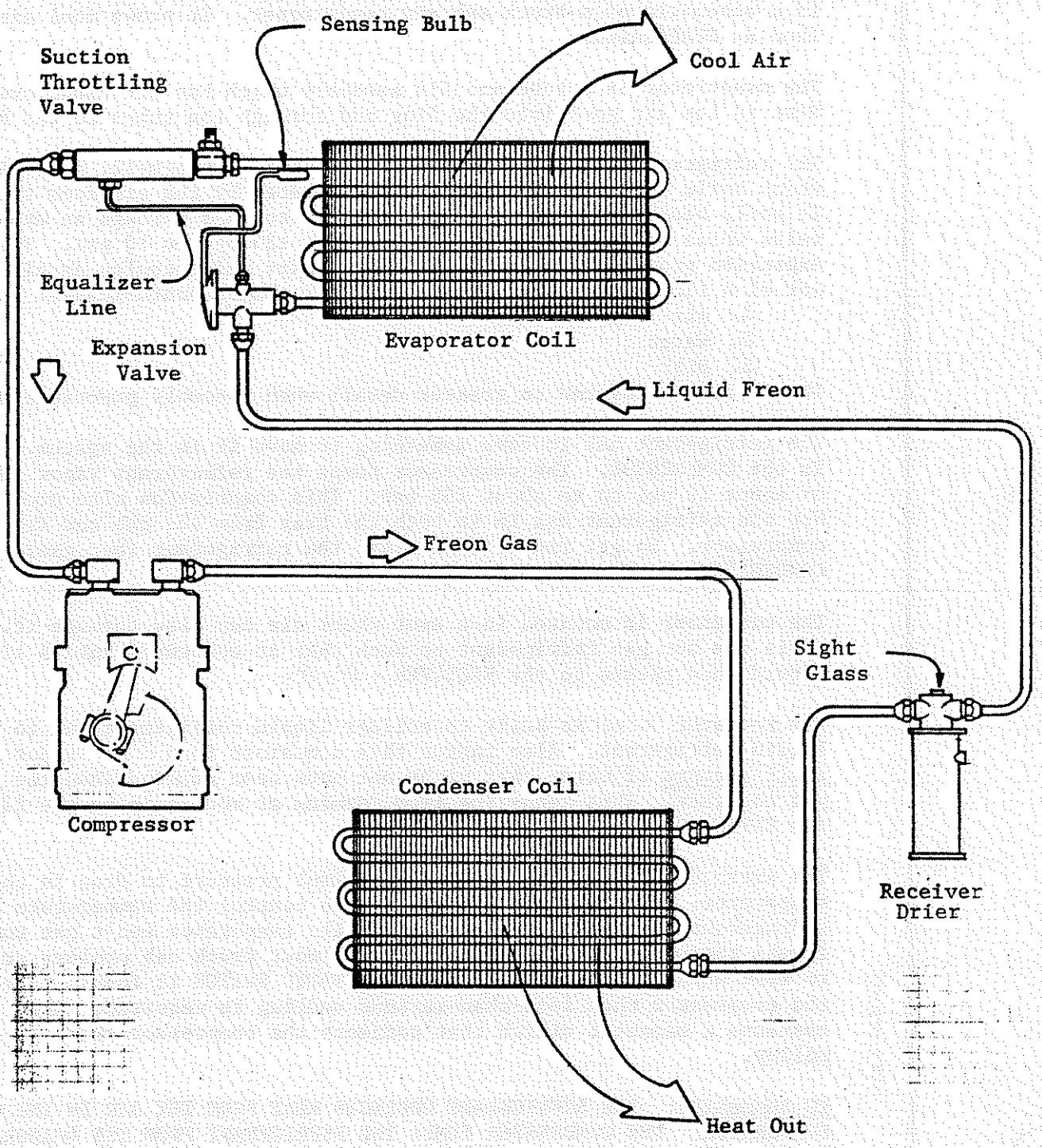


Fig. 1

1. HOW AIR CONDITIONERS WORK

Air conditioners are essentially refrigerators which cool air. Figure 1 is a schematic of a truck cab air conditioner. It shows cool air being blown from an EVAPORATOR.

The evaporator is a tube and fin assembly which has air blown over the coils. Heat in the air goes into the fins and through the tubes to the REFRIGERANT.

The refrigerant in the truck air conditioner is Freon-12, a special fluid which boils in the evaporator as it is heated by the air from the cab. It boils because it has just been allowed to pass through an expansion valve which drops the pressure from about 135 psi to 10 psi. This expansion produces cooling similar to a tire valve cooled as air leaks out of a tire. The refrigerant has three common contaminants:

1. Air
2. Water
3. Dirt

These will be covered in greater detail when assembly practices are discussed.

The refrigerant has to have something to move it in the system. The "mover" is the COMPRESSOR. The compressor pumps the refrigerant vapor from a pres of about 10 psi up to about 135 psi. This compression also produces heat. Now the refrigerant has in it both the heat from the cab and from the compressor. To get rid of this heat, the refrigerant (hot gas) goes to the CONDENSER.

The condenser is mounted in a spot where air can blow through it. This air cools the hot gas refrigerant so much that it condenses into a liquid. This liquid then passes to the RECEIVER - Dryer.

The receiver dryer is built to collect liquid refrigerant and to pass only liquid refrigerant. Also inside this container is a dryer agent to collect small amounts of water that might not have been removed when the system was put together. This keeps ice from forming at and stopping the flow through the EXPANSION VALVE.

The expansion valve allows the refrigerant pressure to drop in the evaporator. It automatically adjusts to control the temperature of the refrigerant leaving the evaporator so the evaporator won't get too cold and freeze the water out of the air. Since most truck cab coolers are set up to work when it's quite hot, a THERMOSTATIC SWITCH is installed to stop the compressor when less-than-maximum cooling is required. This switch operates a magnetic clutch that connects the compressor shaft to the drive pulley.

TO SUMMARIZE: THE REFRIGERANT COLLECTS HEAT FROM THE AIR IN THE CAB IN THE EVAPORATOR. THE COMPRESSOR PUMPS THE REFRIGERANT FROM THE EVAPORATOR, RAISES THE PRESSURE, AND FORCES THE REFRIGERANT INTO THE CONDENSER. THE

(Continued)

A. HOW AIR CONDITIONERS WORK (Continued)

CONDENSER COOLS THE HOT REFRIGERANT ENOUGH TO CHANGE IT BACK TO A LUQUID. THE RECEIVER - DRIER COLLECTS THE LIQUID REFRIGERANT AND HOLDS SMALL AMOUNTS OF WATER FROM GOING AROUND THE SYSTEM. THE EXPANSION VALVE LETS THE REFRIGERANT EXPAND (DROP PRESSURE) INTO THE EVAPORATOR WHERE COOLING TAKES PLACE. A THERMOSTATIC SWITCH CUTS THE COMPRESSOR IN AND OUT TO CONTROL THE AMOUNT OF COOLING.

B. OPERATING INSTRUCTIONS FOR FREIGHTLINER MOD 420A AIR CONDITIONER

The air conditioner system is controlled by two switches located on the air conditioner instrument panel. The temperature control is an adjustable thermostatic switch that maintains the incoming air at a selected temperature. A rise in temperature closes the switch. This in turn energizes the magnetic clutch, putting the freon compressor into operation. The blower motor switch has four positions: "OFF", "LOW", "MED", AND "HI".

1. With engine running, set temperature control to coldest position.

2. Set fan speed on "HI" until the cab is cooled, then reduce fan speed, and lower thermostat setting to maintain desired temperature.

NOTE: To prevent evaporator frosting and icing, avoid the combination of low fan speed, and the coldest thermostat setting, especially on humid days. Should frosting or icing occur, turn the fan switch to "HI", and the thermostat to "OFF" for two or three minutes, then resume cooling at a higher fan speed than before frosting occurred.

3. To quickly cool a hot cab, close outside air vents, turn on air condi-tioner, set temperature on "COLD" and fan switch on "HI", then open a window. These steps will result in the hot air being blown out of the cab. After three minutes, close the window, and the cab will cool to comfortable level quickly.

4. To remove smoke, slightly open a window or vent to admit fresh air.

5. If cab windows fog up, turn the air conditioner on and direct the air louvers toward the windows until the fogging ceases, then set fan switch and thermostat to the desired position.

C. SERVICE OPERATIONS

Refer to Freightliner Maintenance Manual for air conditioner preventive maintenance schedules and operations.

D. ASSEMBLY PRACTICES

1. Compressor Installation: Assembly practice for the air conditioner in the truck starts several places - on the engine line, in the hose shop, on the cab line, etc.

   On the engine line: The refrigerant compressor needs to be mounted with the belts aligned within 1/16 inch. A straight edge on the drive pulley can be used to make sure the alignment is within 1/16 inch. Also, these belts shouldn't be too tight or too loose. The right belt tension is 150-180 lbs. on a single B belt.

2. HOSES:

   1. KEEP THEM CLEAN: Blow out with dry nitrogen.
   2. KEEP THEM DRY: Plug and seal with tight plugs.
   3. KEEP THEM TIGHT: Use refrigerant oil on threads and torque the fittings as follows:

Refrigerant Line Torque

11 HOSE SIZE	STEEL FT/LBS	ALUM. FT/LBS
No. 6	10-15	16 ± 2
No. 8	24-29	16 ± 2
No. 10	26-31	16 ± 2

Prior to installing hose fittings, put Loctite #592 or #242 on male thread portion of the fittings and then tighten to recommended torque.

When tightening fittings, always use the torque reading for the softer metal when unlike metals are used.

Air conditioning is one of the most critical of the truck systems because the refrigerant system can be ruined by one drop of water or a speck of dirt. Remeber these two things:

1. Water will both freeze inside the expansion valve and make acid with the refrigerant. The ice in the expansion valve stops the cooling. The acid will gradually eat the whole system.

2. Dirt will plug the expansion valve and stop the cooling.

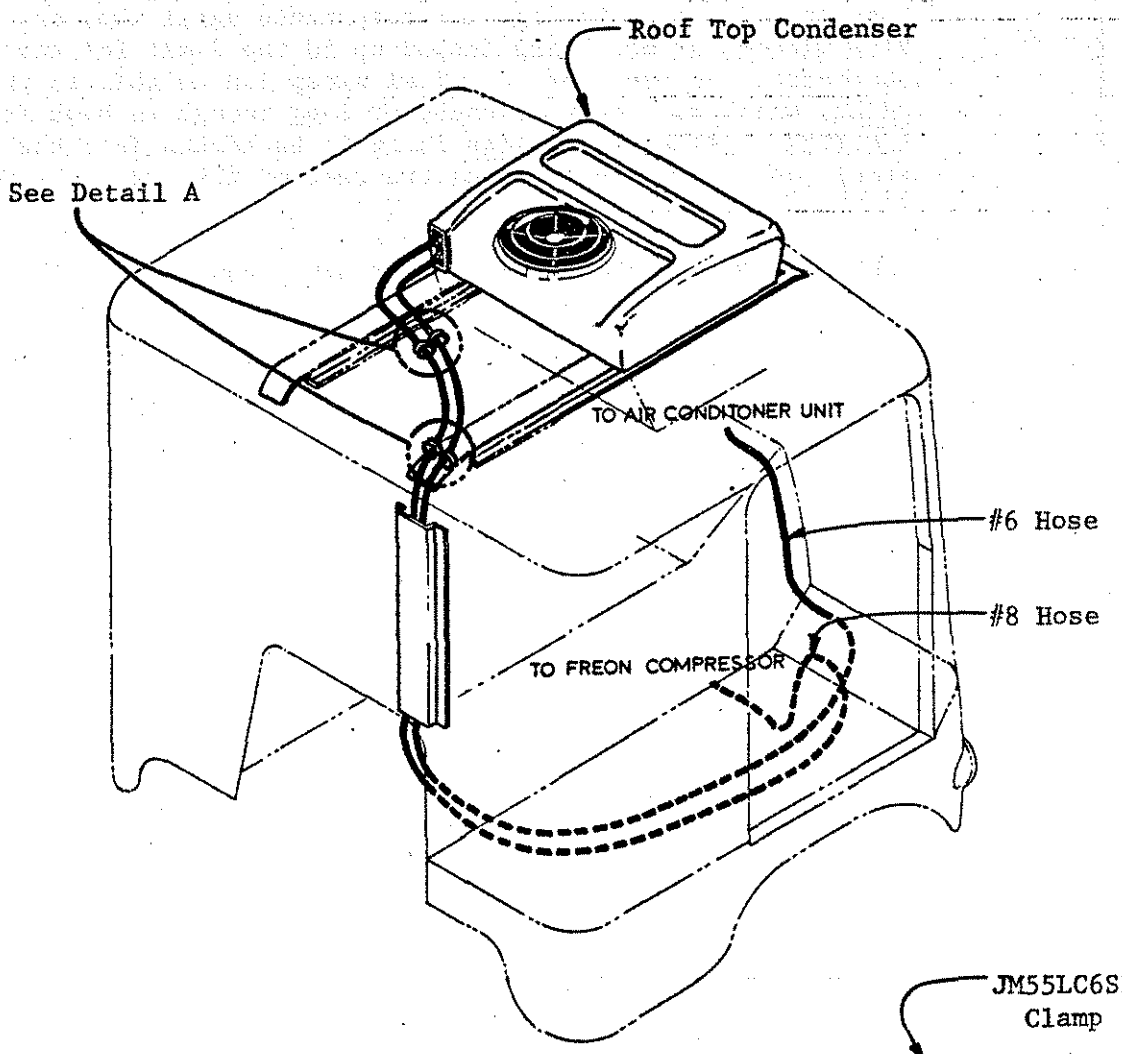
The refrigerant system must be kept clean, dry, and tight. Do not let the dirt, water, and other foreign matter into the system. Only clean refrigeration oil from a closed squirt-can should be used to lubricate refrigerant hose fittings. Only clean, dry rags should be used to wipe excess oil from hose ends. Plugs or caps should be kept on all hosed, tubing, and components until they are connected. Five minutes of not being capped up is the limit for any hose or component. An even more critical exception to this is the RECEIVER-DRIER, which must only be uncapped long enough to hook it up. The RECEIVER - DRIER is the last thing to be hooked into the system; it should only be connected when the rest of the system is COMPLETE and SEALED UP TIGHT.

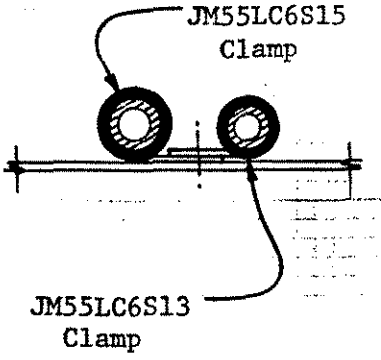
CAUTION: Do NOT blow shop air through freon hoses. Shop air is wet air.

E. FASTINING FREON HOSE

Hose must be separated as shown to avoid chafing and reduce heat tranefer clamps must be JMP, loop cushioned (See Detail A).

Clamp periodically as is necessary to insure smooth hose routing.





Detail A

F. EVAPORATOR-CONDENSER:

Roof mounted units: These units need to have a good seal so rain won't leak into the cab. The refrigerant hoses need to be tightened (using two wrenches!) The drain hose needs to always slope down so it will drain the water away.

Freightliner - Mod 420A: The drain hose must always slope down. If it doesn't an air lock will stop the water and the water will drip onto the driver.

The drain pan if metal should always be insulated so it will not collect water from the air, if plastic, it needs no added insulation.

The cover on the evaporator should be tight against the air seal flange so the air will go through the core and not around it.

Good practice demands that all refrigerant hose fittings be tightened using two wrenches. (The condenser on the unit is aluminum. It needs especially tender care, particularly when the fittings are being tightened.) ALWAYS USE TWO WRENCHES to tighten the fittings.

Keep caps on the hoses, tubing and condenser until ready to hook them up.

G. RECEIVER - DRIER:

As mentioned earlier, the receiver - drier should be hooked into the completed system last. If the system can't be sealed up tight and evacuated right away don't uncap or hook up the receiver - drier. If system has been left open to the air and the receiver - drier was hooked up, a new one must be installed before evacuation and charging.

When a trinary switch is to be installed, the cap on the receiver-drier must only be off long enough to connect the switch, so as not to expose the dessicant to air.

H. TROUBLE SHOOTING

After the air conditioner is built and charged, there may be times when it will not work. There are, in general, three things which will stop an air conditioner from working:

1. Electrical problems
2. Air movement problems
3. Refrigerant problems

1. Electrical problems will show up either in no clutch actuation on the compressor or no fan operation in the evaporator. In the case of roof-mounted air conditioners, it may also show up as no condenser fan operation In the shutter control system, it may also show up as the shutter not actuating when the compressor is operating.

H. TROUBLESHOOTING (Continued)

2. On a new air conditioner, usually the only thing which will stop air from moving is an electrical problem where the blower motor is not operating. This could be a circuit breaker, fuse, defective motor, loose wire, etc. There may be time when the blower motor will be running but very little air flow will be delivered; on new units it may be that the blower wheels are mounted backwards (reverse rotation).

3. The quickest way to learn what is going on in the refrigerant circuit is to install a refrigeration gauge set to the suction and discharge side of the compressor. The following two pages show normal and abnormal conditions regarding refrigerant pressures at the compressor.

   If high discharge pressures are present, it indicates the compressor is all right but that there is either a blockage in the freon lines or the condenser; or the condenser air flow may be too low to carry the heat away.

   If the suction and discharge pressures are both high, it indicates that there is probably air in the refrigerant or too much refrigerant in the system.

   If the suction pressure is too high and the discharge pressure normal, t. capillary bulb on the outlet of the evaporator should be checked. This bulb must be in metal-to-metal contact with the evaporator outlet and covered with insulating tape for proper operation.

   If the suction pressure is too low, air may be bypassing the evaporator core, or ice may be blocking the evaporator, or a restriction on the suction side of the compressor in the hose may have developed.

INSUFFICIENT COOLING?

1. Customer Complaint

2. Air Not Cooling Cab

   A. Moving Air?
   B. Temperature Change?

      (a) Operating Conditions

         1. Fan "high", "cold"
         2. Engine speed at least 1500 rpm
         3. All windows closed
         4. Heater "off"
         5. Fresh air "off"

      (b) Freightliner 420A

         15°F drop in five minutes (For example, 100°F to 85°F)

      (c) Kysor, Frigiking, Mark IV, etc.

         10°F drop in five minutes (For example, 100°F to 90°F)

3. Air Conditioning Pressures

   Engine rpm at least 1500, fan "high", air temperatures into evaporator at least 80°F, "cold" setting.

CONDITION	COMPRESSOR PRESSURE, PSI	
	SUCTION	DISCHARGE
Normal	15-25	125-175
Abnormal:		
A. High Suction High Discharge	30-60	275-400
B. High Suction Normal Discharge	30-60	125-175
C. Low Suction Normal Discharge	0- 6	125-175
D. Normal Suction Low Discharge	15-25	75-100

BEFORE TESTING A/C

1. Check belt tension.
2. Check clutch operation.
3. Check for broken, burst, kinked hoses.
4. Check for condenser air blockage due to bugs, etc.

INSUFFICIENT COOLING

CHECK AIR FLOW

NORMAL AIR FLOW
Inspect system for visual defects. Check air temperature.

NORMAL AIR TEMPERATURE
Check for air leaks through cab doors, windows, or from heater or defroster.

HIGH AIR TEMPERATURE
Check sight glass.

NO OR LOW AIR FLOW
Check Blower Operation.

NORMAL BLOWER OPERATION
Check for restriction or leakage in air ducts, partially closed air outlet valve or clogged evaporator core.

BLOWER NOT OPERATING
Check for blown fuses, defective blower switch, broken wire, loose connections, defective blower motor.

ICE BLOCKING EVAPORATOR
Check for low evaporator pressure. Adjust thermostatic switch.

NO FOAMING
Check for air leaks around evaporator.

FOAMING
System is probably low on refrigerant. Check for leaks, repair and add refrigerant. If foaming still occurs, check in refrigerant system between condenser and sight glass.

NORMAL EVAPORATOR PRESSURE
Check discharge pressure.

LOW EVAPORATOR PRESSURE
If ice is blocking evaporator, adjust thermostatic switch. If cooling remains low, follow diagnosis under "Normal Evaporator Pressure." Hoses to and from valve and suction hose may be restricted or valve may be defective.

HIGH EVAPORATOR PRESSURE
THERMOSTATIC SWITCH
Check for clutch cycle.

HIGH EVAPORATOR PRESSURE
Check installation of capillary bulb. If bulb is tight and pressure is high, remove bulb from pipe.

NO CYCLE
CLUTCH ON
Disconnect clutch wire. If clutch continues to operate, clutch is defective. If clutch stops, thermostatic switch is defective.

CLUTCH OFF
Check electrical circuit through thermostatic switch and clutch solenoid.

HIGH DISCHARGE PRESSURE
Check for air in system, excess refrigerant, restriction in condenser refrigerant tubes or air fins.

LOW DISCHARGE PRESSURE
Check for slipping belt, clutch. Check for restriction in suction line. Check compressor.

NORMAL DISCHARGE PRESSURE
Check for proper seal around evaporator core.

NORMAL EVAPORATOR PRESSURE
EVAPORATOR PRESSURE REMAINS THE SAME
Valve is stuck open and too much refrigerant is entering evaporator. Replace thermostatic expansion valve.

EVAPORATOR PRESSURE INCREASES
Check for clutch slippage, belt slippage and listen for unusual noises. Replace clutch, compressor, or belts as required.

TROUBLE SHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTION
Blower Motor Not Operating	a. Circuit breaker open due to short.	Locate and repair short
	b. Defective blower motor	Replace switch
	c. Loose connector or broken wire in air conditioner circuit.	Repair
	d. Defective resistor	Replace
	e. Defective motor	Replace
Blower Motor Operating but Low or No Air Flow	a. Blower wheel loose on motor shaft	Center blower wheel in cage and tighten set screws.
	b. Blower wheel installed backwards	Remove blower wheel(s) and remount to motor shaft so that the Hub(s) face toward the passenger (R.H.) side of the vehicle. The hub of the blower wheel being that portion containing the set screw.
	c. Blower motor turning backwards	Reverse blower motor leads (See Fig.1 for correct rotation and Fig.7 for wiring diagram.)
	d. Restricted air duct	Remove restriction
	e. Ice blocking evaporator	Replace valve (Expansion)
	f. Low evaporator pressure	Replace valve (Expansion)
	g. Defective suction throttling valve	Replace valve
	h. Air leaks in system	Locate and repair leaks.
Full Air Flow but No Cooling (that is, Evaporator not Cold)	Moisture in system, Receiver-Drier defective	Replace receiver-drier

TROUBLE SHOOTING (Continued)

PROBLEM		POSSIBLE CAUSE	CORRECTION
High Evaporator Discharge Air Temperature			
	With Foaming in Sight Glass	a. System low on refrigerant	Add refrigerant.
		b. Leaks in freon system	Repair leaks. (See 33-22227 "Leak Testing".)
		c. Restriction in line between condenser and sight glass.	Remove restriction in line.
	Without Foaming	System may be empty. Low pressure compressor line not cold. High pressure line on compressor not warm.	Evacuate, charge, and leak test the system. See section titled "Evacuating, Charging, and Leak Testing". (33-2227
	With Low Evaporator Coil Outlet Pressure	a. Suction throttling valve inlet line warm, restriction in line showing frost spots.	Remove restriction or replace line.
		b. Plugged inlet screen in thermostatic expansion valve.	Clean screen in thermostatic expansion valve.
		c. Defective thermostatic expansion valve.	Replace thermostatic expansion valve.
		d. Restrictions in liquid line to thermostatic expansion valve.	Remove line restrictions.
		e. Ice blocked evaporator.	Allow system to warm up with compressor stopped.
		f. Defective suction throttling valve.	Replace suction throttling valve.
		g. Equalizer line to thermostatic expansion valve kinked.	Replace thermostatic expansion valve and equalizer line assembly if kinked or flattened.

TROUBLE SHOOTING (Continued)

PROBLEM	POSSIBLE CAUSE	CORRECTION
High Compressor Discharge Pressure	a. Shutter not opening.	Adjust or repair shutters. Replace shutter solenoid valve.
	b. Condenser air flow restricted.	Remove restriction of air flow through condenser.
	c. Refrigerant restriction in condenser. Return tube bends should be same temperature.	Replace condenser.
	d. Air in system.	Repair leaks in system. See "Leak Testing" 33-22227.
High Evaporator Discharge Pressure	Thermal bulb not secure to evaporator line or contact area not clean.	Clean tube and secure bulb to tube.
Equalizer Line Frosty or Cold	Suction throttling valve not operating due to moisture freezing piston.	Allow system to warm up. Restart engine, check evaporator outlet pressure. If still low replace suction throttling valve.
Equalizer Line Warm	a. Clutch or belt slipping.	Clean clutch facing. Adjust belt tension.
	b. Suction line restricted.	Remove restriction(s).
	c. Compressor in need of repair.	Repair or replace compressor.
Evaporator Outlet Air Temperature Drops as Compressor Discharge Pressure Drops	Leaks in system.	Repair leaks. (See "Leak Testing" 33-22227).
Evaporator Outlet Air Temperature Increases as Compressor Discharge Pressure Drops	Thermostatic expansion valve setting is low.	Replace thermostatic expansion valve.

TROUBLE SHOOTING (Continued)

PROBLEM	POSSIBLE CAUSE	CORRECTION
Temperatrue in Cab Too High with Normal Evaporator and Discharge Pressure	a. Heater water shutoff valve not closed.	Close heater water valve.
	b. Air door to heater not closed (temperature door).	Close heater air door and make sure cable linkage is free from binding and is engaging full travel.
	c. Seal leakage, evaporator to-cover.	Reseal cover to evaporator.
	d. Heater shutoff door not sealing.	Reseal heater door.
Cab Will Not Cool Down 15° F. In 5 Minutes.	a. Fresh air inlet open	Move Htr. lever for "Air Mode To Off".
	b. Heater "ON"	Switch off WK-30 and/or aux. Htr.
	c. Window open	Close windows & air vents i doors & sleeper compt.
	d. Low engine speed	Engine speed to be at least 1500 RPM.
	e. A/C Fans on low	Set fans on high & thermo. on cold.
Evaporator Outlet Air Temperatrue Increases as Compressor Discharge Pressure Drops	a. Excessive oil in system. An indication of this is clutch slippage or belt slippage at governed engine speed.	Set controls at high blower and maximum cold, operate engine at idle for ten minutes. Discharge system and drain excess oil from compressor. Evacuate, charge and leak test system.
	b. Excessive oil in thermostatic expansion valve and suction throttling valve.	Remove thermostatic expansion valve and suction throttling valve. Drain oil from valves and flush the remaining components with R-11 flushing fluid or equivalent to remove any remaining oil. Reinstall valves. Refill compressor with new oil. Evacuate, charge and leak test system. (See 33-22227)

WEATHERKING HEATER INSTALLATION (MODELS 30, 35, 40 & 45)

1. HEATER CORE HOUSING ASSEMBLY

A. Install a strip of 1/16" x 1" x 8-1/2" Weatherban sealant tape on each of the four tank end radii as shown (Fig. 1, 2).

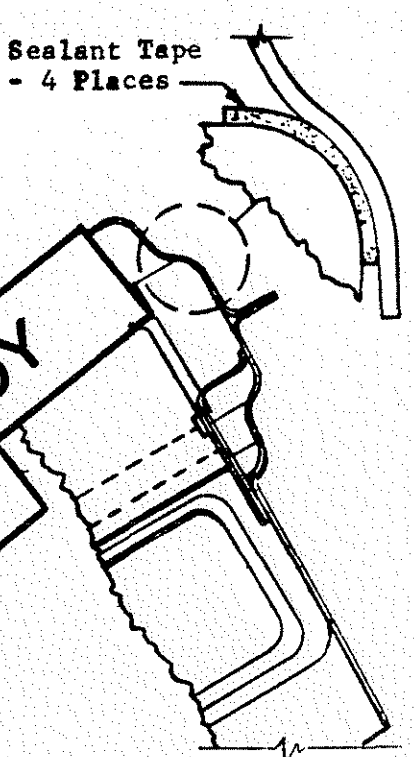


Fig. 1

B. Position the heater core in the lower heater core housing. Install heater core housing gasket.

C. Position the upper core housing on the lower core housing assembly. On internal-lin[k] type air-mix doors, be [sure] temperature control [lever] out through the ny[lon] Install the bolt[s] ing the upper [and] lower housi[ng]

D. On int[ernal-link]ati[on] [type] [air-mix] cab[le] [with] [the] [large] open[ing] [around] the core. Install heater-to-deck gasket, using H.B. [Fuller] #900 cement or equivalent.

REMOVE & DESTROY 8-16-83

E. Position the heater core assembly on the underside of the deck. On internal-linkage type air-mix doors, be sure the temperature control lever sticks up through the hole in the deck.

F. Install gasket on the air inlet adapter, then position the air inlet adapter in place. (Fig. 3)

G. Install the four hex-head and three round-head capscrews attaching the heater core assembly and the air intake adapter to the deck.

H. On internal-linkage type air-mix doors, install the swivel and lock nut, leave loose for cable adjustment.

J. Seal the joint between the heater housing and the air intake duct with caulking compound per 33-00114 (Location of joint is shown on 33-22216 p. 3, Fig. 4.)

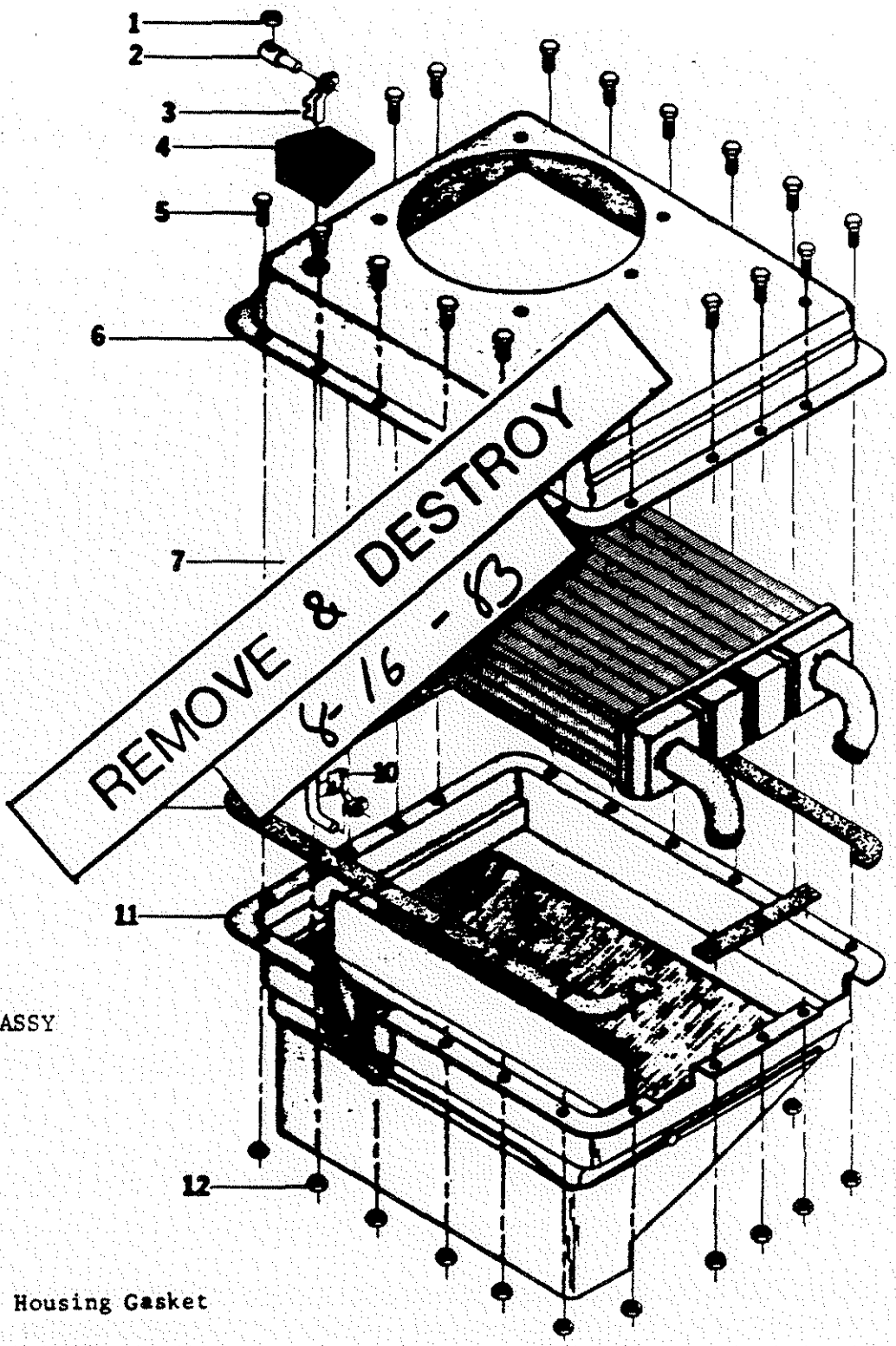


Fig. 2
CORE HOUSING ASSY

1. Lock Nut
2. Swivel
3. Rod Clip
4. Cable Core Housing Gasket
5. Bolt
6. Upper Core Housing Assembly
7. Heater Core Assembly
8. Temperature Control Lever
9. Heater Core Housing Gasket
10. Rod Clip
11. Lower Core Housing Assembly
12. Lock Nut

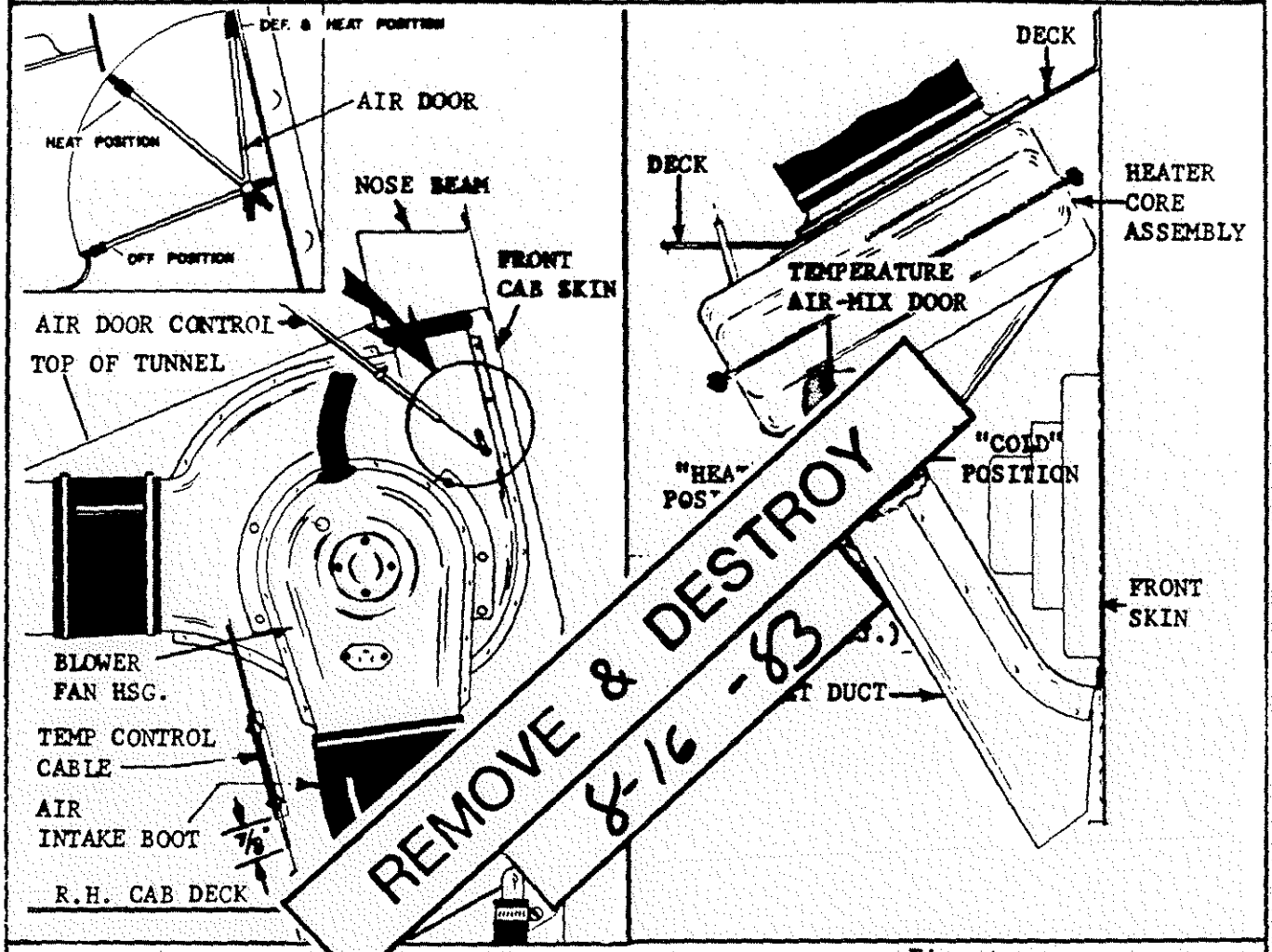


Fig. 4

2. HEATER CONTROL CABLE ADJUSTMENTS - The control cable of each air door must be adjusted properly to insure correct air door operation.

A. Air Control Cable (See Fig. 3)

(1) Remove the screws attaching the heater cover to the tunnel and deck, then remove the cover.

(2) Disconnect control cable from air door. Block the "air" control lever in the panel 1/8 to 1/4 inch away from extreme "OFF" position (use small screwdriver).

(3) Check the air door operation. Be sure the air door works freely, has full movement and seals properly when in the "OFF" position.

(4) Put the air door in the "OFF" (down) position.

(5) Move the cable assembly in the clamp until the cable loop will engage the air door handle. Tighten the cable clamps.

(6) Install the rod clip and cable loop on the air door handle.

(7) Using the "AIR" lever located in the control panel, recheck the air door operation.

B. Temperature Control Cable (See Figs. 3 & 4)

REMOVE & DESTROY 6-16-83

(1) With the control cable disconn[illegible]e air-mix door. push the "TEMP" lever, located in [illegible] panel to the "HOT" position.

(2) Check the air-mix do[illegible]ure the door works freely and has full mover[illegible]

(3) Position the [illegible]able in the cable mounting bracket wi[illegible]e housing extended 7/8" below the bottom e[illegible]ee Fig. 3) Tighten the saddle clamps.

(4) Put [illegible] the "HOT " position.

(5) [illegible]ck nut and turn the swivel until it will [illegible]e cont[illegible]l cable loop. Hold the swivel in place and tighten [illegible]ck nut. Install the rod clip and cable loop on the swivel.

(6) Using the"TEMP" lever located in the control panel, recheck the air-mix door for full range of travel inside the housing.

C. R.H. - Bunk Outlet Control Cable (See Fig. 5 & 6)

On sleeper models this outlet control is "R.H." or "BUNK"; on non-sleeper models it is "R.H." or "OFF".

(1) With the control cable disconnected from the air door, push the "R.H." - "BUNK" or "OFF" lever located in the bunk control panel to the "BUNK" or "OFF" position.

(2) Check the air door operation. Be sure the air door works with light drag and has full movement.

(3) Put the air door in the "BUNK" or "OFF" (to the right) position.

(4) Move the cable assembly until the cable loop will engage the air door handle. Tighten the cable clamps.

(5) Install the rod clip or push-on locks and cable loop on the air door handle.

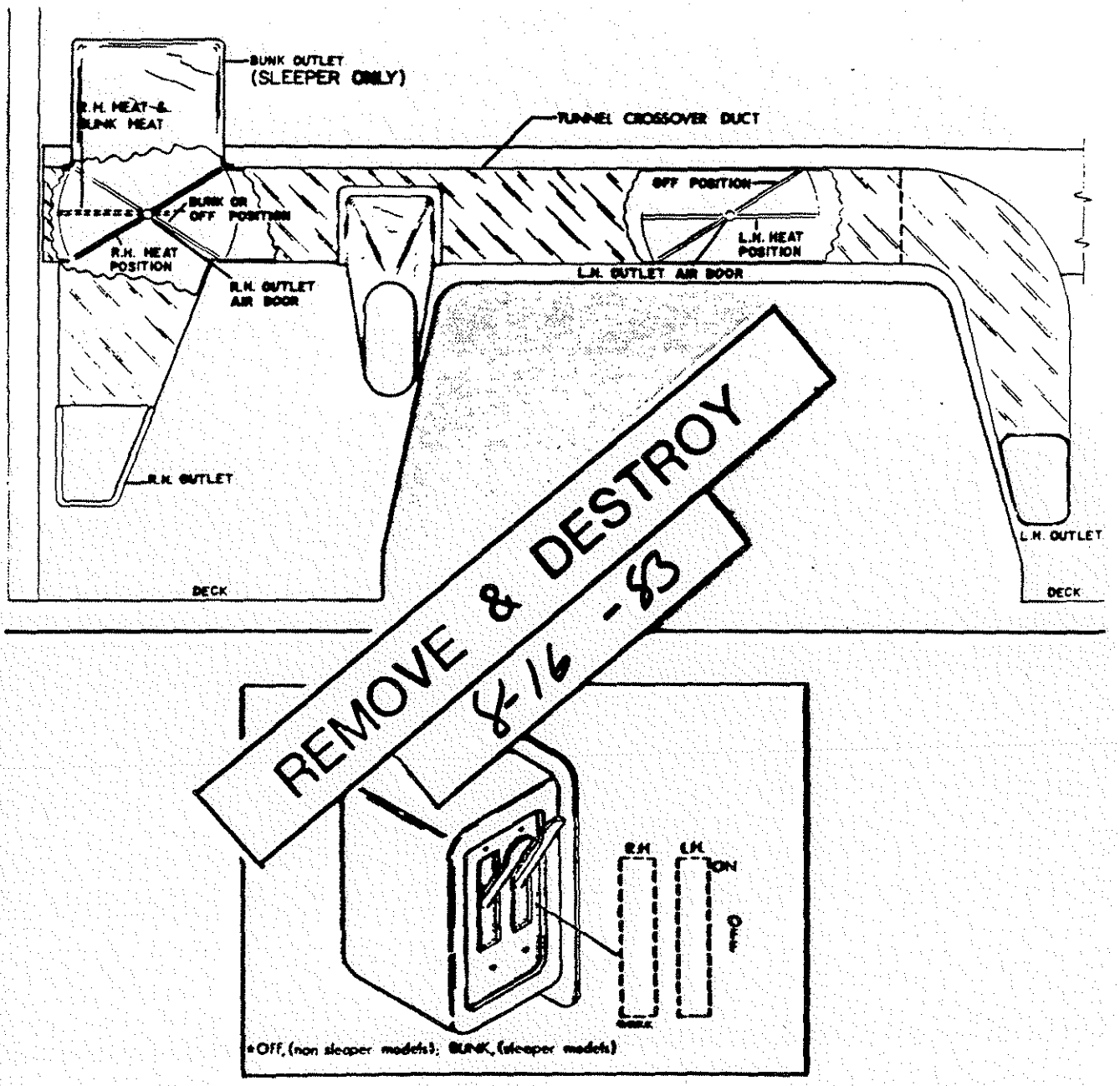


Fig. 6

(6) Using the "R.H." lever located in the bunk control panel, recheck the air door operation.

D. L.H. - Bunk Outlet Control Cable (See Fig. 5)

The "L.H." - "OFF" control cable located in the bunk control panel is a fixed length, non-adjustable cable.

COMPILED	D L	SHOP PRACTICE SEAT BELT INSTALLATION	SECTION NUMBER 33-22218
APPRV	D L		
ISSUE DATE	05/01/86		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	B		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-008 FOR SEAT BELT INSTALLATION PROCEDURE.

Compiled	D.LELANCHON	SHOP PRACTICE SEAT BELT INSTALLATION	33-22218
Approved			
Issued	5/1/86		
Revised	9-4-87	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	

1. TETHER STRAP INSTALLATION:

With no weight in the seat and the seat in the highest ride position, adjust the Seat Belt Tether Strap Assembly (seat-base-to-deck strap) by pulling the center webbing strap directly away from the buckle to remove all extra slack. Tether belts should not be so tight as to restrict movement of suspension seats. Be sure straps are not twisted.

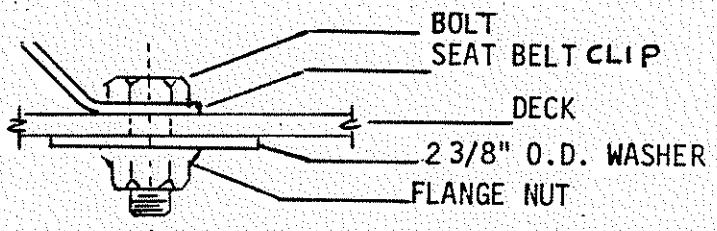
A 2. LAP BELTS:

Refer to the individual seat belt installation diagrams.

A 3. SEAT BELT ANCHORAGE:

For cab decks that are flat and clear underneath in the mounting area.

Note: The nut, bolt and washer are furnished as part of the seat belt kit.



4. NATIONAL SEATING COMPANY MODEL 95

These seats require a bottom cushion tie strap, which is normally installed at the National factory. On unupholstered seats, the tie strap is stapled to the cushion bottom and must be installed after upholstering as follows:

Shift the cushion all the way forward and set the rear cushion risor at its highest position. Loop the tie stap around the center longitudinal web and the cushion riser cross bar and tighten.

5. LAP BELTS WITH RETRACTORS

A. Tube frame:

Install two each (1mm) 3200 wind-up reels, one one each half of the lap belt.

6. NATIONAL SEATING COMPANY MODEL 95

These seats require a bottom cushion tie [illegible] is normally installed at the National factory. On [illegible]red seats, the tie strap is stapled to the cushion bott[illegible] be installed after upholstering as follows:

Shift the cushion all th[illegible] set the rear cushion riser at its highest [illegible]ie strap around the center longitudinal [illegible] riser cross bar and tighten.

REMOVE & DESTROY 9-4-87

Compiled	N.L.K.	SHOP PRACTICE FLOOR MAT/CARPET INSTALLATION	33-22219
Approved	C. DAY		
Issued	3-29-71	Chg Ltr B **FREIGHTLINER CORPORATION** PORTLAND, OREGON	
Revised	4-4-80		

A. CUT OUTS FOR FLOOR-MOUNTED ACCESSORIES

At time of installation of each accessory that fastens to the cab floor, make a neat cut-out of suitable size in the floor mat to accommodate it.

The following are typical of this category:

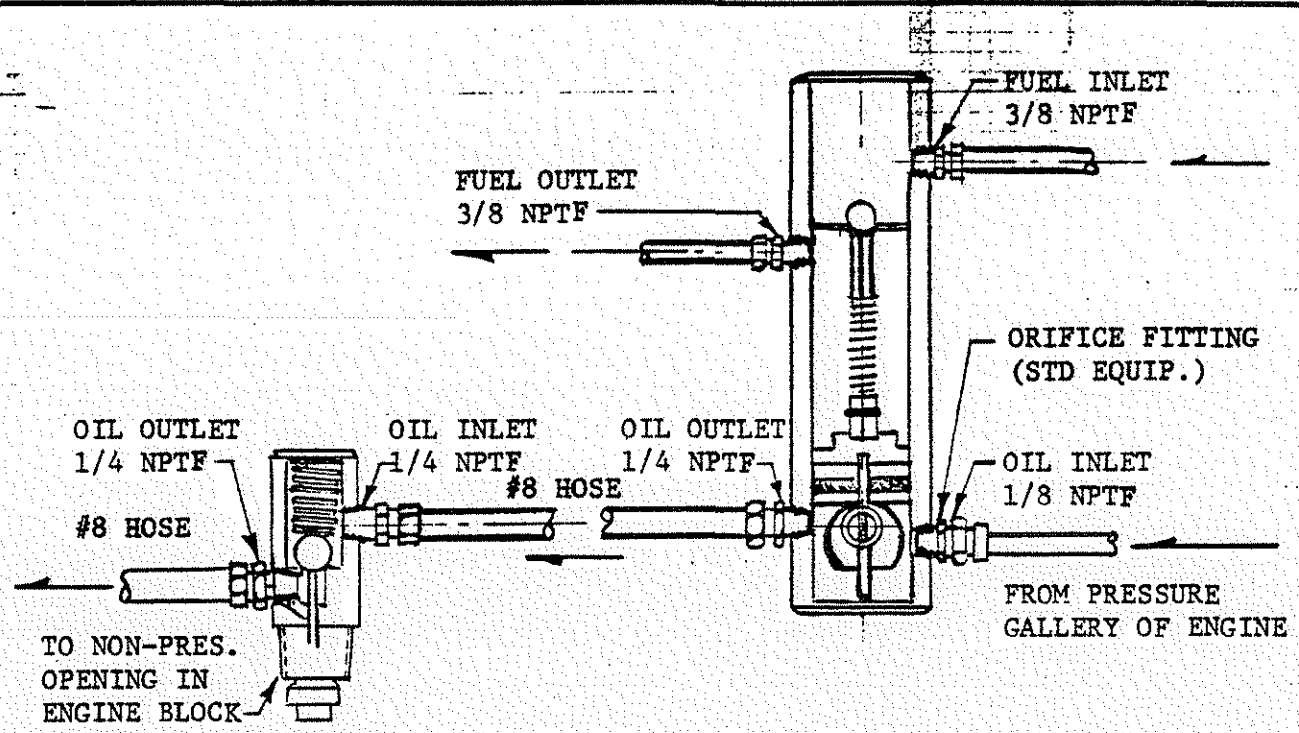
Driver Seat
Tool Box Seat
Auxiliary Seat Mounting Bracket
Heater
Heater Cover
Windshield Washer Bottle

(J) On Conventionals equipped with carpeting, the carpet hold down angle is to be bent to fit in the finished cab line.

OBSOLETE
1-34-84

REVISED & RETYPED "A" Chg

Compiled	N.J.R.	SHOP PRACTICE HEAT & OIL SENTINEL INSTALLATION	33-22220
Approved	BRAY		
Issued	11-22-71		
Revised	12-4-72	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1



GENERAL

The Heat & Oil Sentinels are devices designed to function together as a system to cut off fuel to the engine in case either:

(a) The engine temperature exceeds a predetermined safe level, or
(b) Engine lubricating oil pressure falls below safe operating values.

For the system to function properly all oil and fuel line connections must be made exactly as specified, and with proper size hoses.

INSTALLATION

1. Mount Oil Sentinel securely on its bracket at correct location in relation to fuel pump (Ref. D22-11885, D22-11886, D22-13370).

2. Connect fuel inlet from filter or fuel pump to Oil Sentinel; use hose or line with 3/8" N.P.T. fitting.

3. On CUM or CAT engines, connect fuel outlet from Sentinel to suction side of fuel pump. For DDE engines, the fuel plumbing must be between the final filter and the fuel rail.

4. Screw Heat Sentinel into hottest possible water jacket access opening of engine--CAUTION: Check opening and cavity in engine for obstructions--the brass vernatherm of Heat Sentinel must not be squeezed or distorted as a result of installation.

INSTALLATION (Continued)

5. Connect oil inlet from pressure gallery of engine, using a (3/16" I.D. maximum) Stratoflex hose or equivalent line direct to orifice fitting in Oil Sentinel.

6. Connect oil outlet of Oil Sentinel to oil inlet of Heat Sentinel using C #213-8 (13/32"I.D. or larger) Stratoflex hose or equivalent line; DO NOT C USE LINE WITH LESS THAN 13/32" I.D. (Optional Extra: See self-testing in diagram.)

7. Connect oil outlet in Heat Sentinel to non-pressure opening in engine C block, using same size as in 6.

8. Use an inline check valve in all fuel return lines going back to tank. (Mandatory on GM Diesel)

A CAUTION: USE STRAIGHT FITTINGS WHENEVER POSSIBLE AND AVOID SHARP BENDS IN LINES: DO NOT USE 90° ELBOWS IN FUEL LINES.

Compiled	S. Hobart	SHOP PRACTICE HOTSTART INSTALLATION	33-22221
Approved	[illegible]		
Issued	3-6-72	Chg Ltr B	
Revised	5-30-72	FREIGHTLINER CORPORATION PORTLAND, OREGON	

HOTSTART PIPING

B

A. Inlet piping to the Kim Hotstart must be provided with a pressure head (i.e. the water level of the source must be higher than the intake opening) in order to achieve gravity feed. Also, the piping must not make any complete loops in its routing to the inlet.

B. The outlet hose from the Kim Hotstart must run continuously up to the engine, without loops or high spots, and with a minimum rise of six inches. Except for the thermostat housing, use any accessible open return on the engine block.

C. If Hotstart is mounted on the frame rail, plumb it to that side of the engine, and not the opposite side.

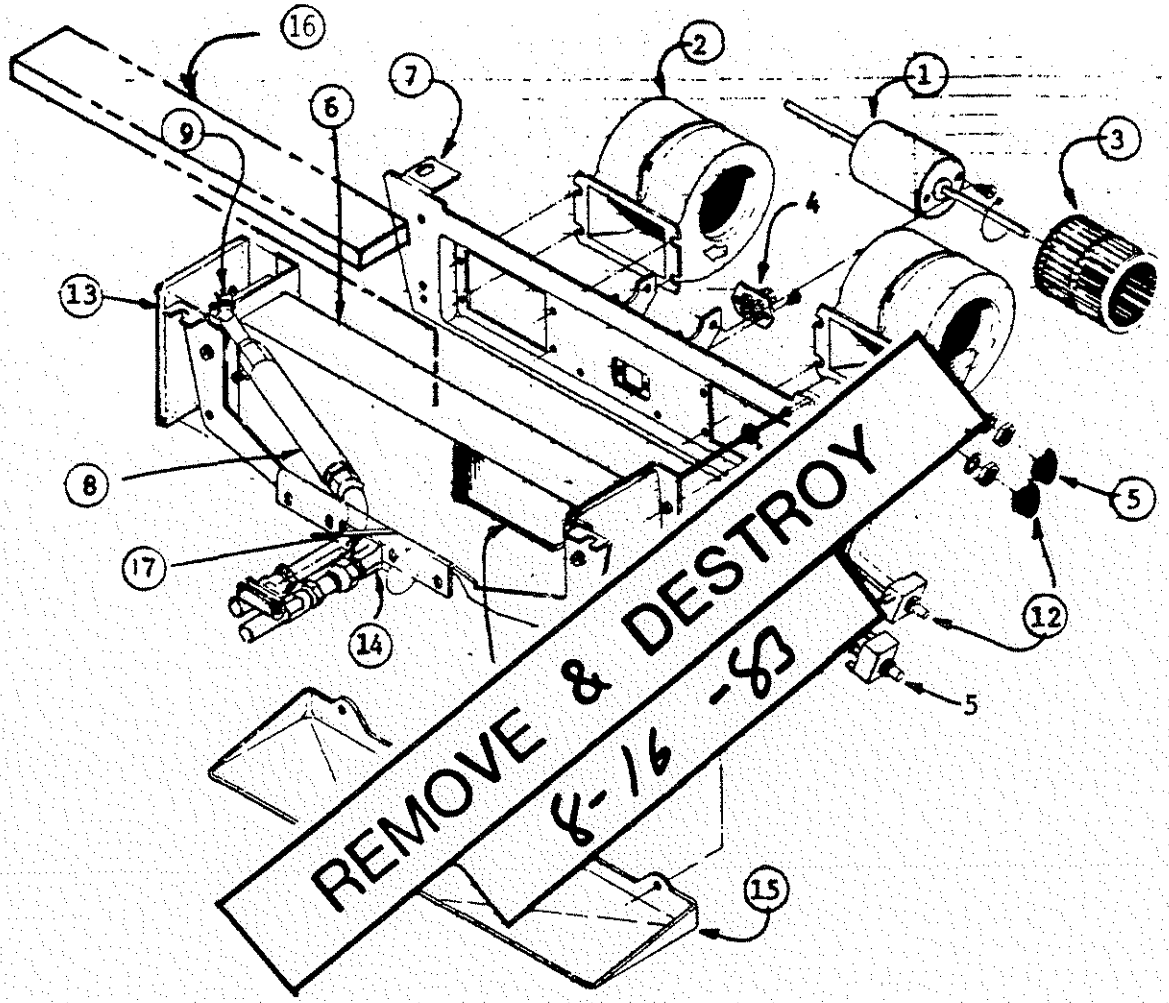
D. Do not use street elbows anywhere in the Hotstart piping.

A Revised & Retyped 3-6-72

*For routing of hoses, see 33-12101 Routing of Flexible Lines. Note especially paragraph 2 "Avoiding Heat".

Compiled	RLK	SHOP PRACTICE AIR CONDITIONER KIT ASSEMBLY FREIGHTLINER MOD 420A	33-22222
Approved	TRAUB		
Issued	12-4-72		
Revised	4-4-80	Chg Ltr E FREIGHTLINER CORPORATION PORTLAND, OREGON	Page 1

D



E

Fig. 1

A. EVAPORATOR BLOWER MOTOR AND HOUSING (See Fig. 1)

1. Center blower motor (1) on mounting bracket with the wire leads to the right side as viewed from the back. Rotation is counter-clockwise viewed from the wire end.

2. Install the four blower motor mounting screws and tighten.

3. Install the fan housings (2) by positioning them over the blower motor shaft ends, then install screws attaching the fan housings to the evapora-tor frame. Position the fan (3) on the blower motor shaft and tighten the Allen head set screw. Hubs on fan wheels must both be to the RH side as viewed from the back, the hub being that portion that contains the set screw.

4. Connect the blower motor wires using the marked,or the wiring diagram under "SPECIFICATIONS", 33-22208.

REVISED & RETYPED "B" CHG

B. RESISTOR AND BLOWER MOTOR SWITCH (See Fig. 1)

1. Install resistor (4) blower motor switch (5) in the evaporator frame.

2. Connect the wires using previously marked identification or the wiring diagram under "SPECIFICATIONS", 33-22208.

C. EVAPORATOR COIL (See Fig. 1)

1. Position evaporator coil (6) in frame (7) and attach to frame with machine screws.

2. Apply refrigerant oil to O-ring(s) and fi[illegible], then connect suction throttling valve (8) to evaporator [illegible]ine and thermostatic expansion valve (14) to evaporator co[illegible]. Connect equalizer line to suction throttling valve. [illegible]ches when tightening connections to avoid twisting of tubir[illegible]he connections to the torque values given in Table 1 under [illegible] 33-22208.

3. Clamp thermal bulb (9) t[illegible]let tube with a plastic or copper retainer strap[illegible]ulb with refrigeration insulating tape. (Ref. 4[illegible]

4. Position the t[illegible]ng tube (10) through the frame grommet, then through [illegible]fins near the end. Use a thin screwdriver or an awl [illegible]ins for tubing insertion, then insert tubing below t[illegible]xit below the second row or tubes on the opposit[illegible]nboa[illegible]nd 1" deep.

5. Position [illegible] thermostat switch (12) in the frame, then install the nut attaching the switch to the frame.

6. Install refrigeration tape and insulating pads (13) over evaporator coil tubing on each end.

D. DRIP PAN (See Fig. 1)

Install drip pan (15) to evaporator coil frame using machine screws.

E. SEAL (see Fig. 1) NON SLEEPER CABS ONLY

Install seal (16) to evaporator coil by applying foam adhesive to side plates and rear frame assembly (7) only. Care must be taken not to drip adhesive on coil fins.

REMOVE & DESTROY 8-16-83

C

C

REVISED & RETYPED "A" CHG

C F. THERMOSTATIC EXPANSION VALVE

1. Remove plug from evaporator coil line, then put expansion valve (14) in place; apply refrigerant oil to O-rings and threads. Connect evaporator coil line to expansion valve, and tighten the connection to the torque valve given in Table 1 under "SPECIFICATIONS", 33-22208.

2. Connect the equalizer line to the suction throttling valve. Tighten the connection to the torque value given in Table 1 under "SPECIFICATIONS", 33-22208.

C G. SUCTION THROTTLING VALVE

1. The suction throttling valve (8) is use[illegible] pressure and temperature of the evaporator. The valve i[illegible] is not repairable. If proven to be defective it must be [illegible] a new valve:

   a. Remove the plug from the [illegible] outlet line. Install the suction throttling val[illegible] coil line. Tighten the connection to the to[illegible] able 1 under "SPECIFICATIONS" 33-22208.

   b. Remove plug f[illegible] rt on the suction throttling valve. Connection [illegible] given in Table 1 under "SPECIFICATIONS" 33-22208.

REMOVE & DESTROY 8-16-83

B 2. In orde[illegible] tion from forming on the valve, resulting in wate[illegible] ming [illegible] of the RH vent, the valve is to be wrapped wit[illegible] tape (48-2189).

D 3. The tie wrap (17) must be tight around the suction throttling valve, expansion valve and forward frame in order to prevent any relative movement of the parts.

REVISED & RETYPED "A" CHG

Compiled	T. YOUNG	SHOP PRACTICE ANTENNA CALIBRATION	33-22223
Approved			
Issued	10-7-77	Chg Ltr	
Revised		**FREIGHTLINER CORPORATION** PORTLAND, OREGON	Page 1

I. BOW/CB930

a. Hook-up antenna to S.W.R. meter and S.W.R. meter to radio (antenna plug).
b. Set "CB-PA" switch in "CB" position.
c. Set "CB-MON." switch in "CB" position.
d. Set "SWR-CAL-RF" switch in "CAL" position.
e. Turn unit on.
f. Set "channel selector" switch on channel #20.
g. Depress mic. switch and rotate "SWR CAL" switch until needle on radios S.W.R. meter aligns with set mark. Release mic. switch.
h. Set "channel selector" switch on channel #1.
i. Depress mic. switch and record S.W.R. meter reading.
j. Set "channel selector" switch on channel #40.
k. Depress mic. switch and record S.W.R. meter reading.
l. If channel #1 is a higher reading than channel #40, lengthen the antenna (1/8" at a time). If channel #40 is higher reading than channel #1, shorten the antenna (1/8" at a time).

NOTE: Readings of less than 2.0 on both channels is acceptable. See section on antennas for procedure to follow in adjusting the different antennas.

II. BOW/CBR9950

a. Hook up antenna to S.W.R. meter and S.W.R. meter to radio (antenna lead).
b. Set "ANL" switch in "off" position.
c. Set "RAD/CB" switch in "CB" position (out).
d. Turn unit on.
e. Set "channel selector" switch on channel #1.
f. Depress mic. switch and record S.W.R. meter reading.
g. Set "channel selector" switch on channel #40.
h. Depress mic. switch and record S.W.R. meter reading.
i. If channel #1 is a higher reading than channel #40, lengthen this antenna (1/8" at a time). If channel #40 is a higher reading than channel #1, shorten this antenna (1/8" at a time).

NOTE: Readings of less than 2.0 on both channels is acceptable. See section on antennas for procedure to follow in adjusting the different antenna's.

III. NT/HTMI "HUSTLER"

a. Loosen set screw in outer housing above coil.
b. Move inner core up or down as required (1/8" at a time). Recheck S.W.R. reading after each adjustment. (Adjust both antennas simultaneously.)
c. When proper reading is attained, tighten set screw.

IV. AMX/AAMT-11-4, AMX/8AB-11-5 "HELIWHIP"

a. Remove cap from top of antenna.
b. Pry out short length of coil wire.
c. Cut off 1/8" of wire, and recheck S.W.R. reading. Adjust both antennas (if dual antenna instrument) simultaneously.
d. When proper reading is attained, push wire back into core and replace cap.

Compiled	W.J.R.	SHOP PRACTICE AIR CONDITIONER INSTALLATION, FRIGIKING	33-22224
A Approved	RLK		
Issued	10-29-73	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised	6-18-76		

CAUTION:

When undertaking to install this air conditioner adhere closely to instructions in literature provided in kits, especially regarding:

1. Slope of roof-mounted unit (for proper drain).
2. Drain hose routing, length and cutting.
3. Any other information pertinent to proper [illegible]ilation.

REMOVE & DESTROY
8-16-83

Compiled	H.A.R.	SHOP PRACTICE AIR CONDITIONER INSTALLATION, MARK IV *	33-22225
A Approved	RLK		
Issued	10-29-73	Chg Ltr A FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised	6-15-76		

CAUTION:

When undertaking to install this air conditioner adhere closely to instructions in literature provided in kits, especially regarding:

1. Slope of roof-mounted unit (for proper drain).
2. Drain hose routing, length and cutting.
3. Any other information pertinent to proper [illegible]llation.

REMOVE & DESTROY
8-16-83

*Division of Mitchell, John E., Company

Compiled	M.J.R.	SHOP PRACTICE AIR CONDITIONER INSTALLATION, THERMOKING	33-22226
Approved	RLK		
Issued	10-29-73	FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised	C-18-76 Chg Ltr A		

A

CAUTION:

When undertaking to install this air conditioner adhere closely to instructions in literature provided in kits, especially regarding:

1. Slope of roof-mounted unit (for proper drain).
2. Drain hose routing, length and cutting.
3. Any other information pertinent to proper installation.

REMOVE & DESTROY
8-16-83

COMPILED	B LEVINGS	SHOP PRACTICE AIR CONDITIONER, INSTALLATION, EVACUATION, VACUUM CHECK, & CHARGING	SECTION NUMBER 33-22227
APPRV	D SEEMAN		
ISSUE DATE	09/16/85		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	G		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-009 FOR AIR CONDITIONER, INSTALLATION, EVACUATION, VACUUM CHECK, & CHARGING PROCEDURE.

ADRIENNE CHILBERG

FREIGHTLINER CORPORATION

ENGINEERING STANDARD

DATE ORIGINATED	RELEASE NUMBER	REVISION	STANDARD NUMBER	PAGE
12/02/96	P01310-01	H	33-22227	1 OF 3

SUBJECT: A/C HOSE ROUTING

PRELIMINARY:

The main A/C hoses connect the following components together to form a closed refrigerant circuit; A/C compressor, condenser, reciever/drier junction block, thermal expansion valve (TXV), and the evaporator. If a vehicle is equipped with an auxiliary HVAC system, a parallel refrigerant circuit containing a second TXV and evaporator connect to the main refrigerant circuit at the junction block.

HOSE ASSEMBLY:

Hose assemblies must be free of dirt, grease, oil, flux, moisture and any other foreign material at the time of installation on a vehilce. Tube ends and fittings must be free of nicks or scrathes.

Lubricate fitting threads and o-ring assemblies with 48-02411-000 mineral oil.

A/C FITTING TORQUE TABLE:

Hose Size	Fitting Torque
#6	20-25 ft-lbs
#8	30-35 ft-lbs
#10/12	35-40 ft-lbs

One inch fittings on the A/C compressor need to be torqued 21-27 ft-lbs regardless of hose size.

The retainer plate bolt on the Century Class junction block must be torqued to 15-19 ft-lbs.

Pressure switches must be torque to 8-10 ft-lbs.

Clamping:

Only rubber bound cushion clamps are to be used to secure an A/C hose to a fixed mounting fixture. Cushion clamps should be approximately .0313 inch (1/32") smaller than the OD of the hose. This fit will avoid abrasion of the hose by the clamp. Hoses should be clamped approximately every 20-24 inches in areas where there is no relative movement.

A tie strap may be used between clamps to secure two hoses to each other as long as there is no relative motion. Tie straps should be snug without crushing or deforming the hose. Never use a tie strap to secure a hose to a fix mounting feature.

ADRIENNE CHILBERG

FREIGHTLINER CORPORATION

ENGINEERING STANDARD

DATE ORIGINATED	RELEASE NUMBER	REVISION	STANDARD NUMBER	PAGE
12/02/96	P01310-01	H	33-22227	2 OF 3

SUBJECT: A/C HOSE ROUTING

Although hoses should not be crossed, it is sometimes unavoidable. If two hoses cross, they should be clamped together at the junction point with a cushion clamp.

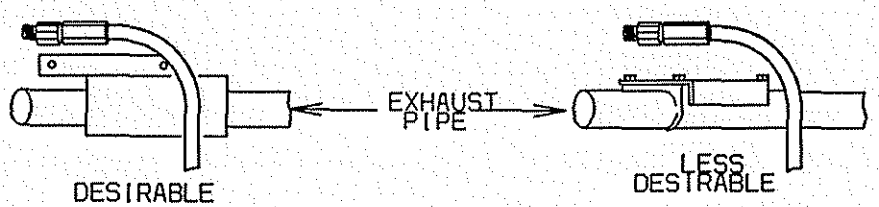
Tie straps should only be used if hoses are running parallel to each other. If the hoses are not parallel, then cushion clamps must be used to secure the hoses.

ROUTING:

All hoses should be routed to avoid interfering with routine maintenance components such as fluid checks and fills, fuel and coolant filters, air cleaners, etc. These routinely serviceable components should be readily accessible for adjustment or element removal without the need to relocate or remove any hoses. Also, hoses should not be located on top of anything likely to be stepped or walked upon.

Parker Hannifin P-80 A/C hose has good heat resilience. However, excessive heat beyond the tolerance limit of the hose will rapidly deteriorate the material. Hoses must be routed at least 4.00 inches away from sources of intense heat such as turbos and engine exhaust piping. More clearance is better, especially if the hoses are routed above the heat source.

If the hoses cannot be routed more than 4.00 inches away from the heat source, a sheet metal shield should be provided between the two to cut down the heat radiation. An air space must be provided on both sides of the shield to allow the heat to dissipate. The shield must be long enough to provide protection along the entire length of exposure. The shield should be attached to a "cold" part, rather than to a heat source, if possible. see figure 1.



-SHIELD ATTACHED TO "COLD" SURFACE
-HAS AIR GAP
-COVERS AREA OF EXPOSURE

-SHIELD ATTACHED TO "HOT" PART
-HAS NO AIR GAP
-DOES NOT COVER AREA OF EXPOSURE

FIGURE 1

ADRIENNE CHILBERG

FREIGHTLINER CORPORATION

ENGINEERING STANDARD

DATE ORIGINATED	RELEASE NUMBER	REVISION	STANDARD NUMBER	PAGE
12/02/96	P01310-01	H	33-22227	3 OF 3

SUBJECT: A/C HOSE ROUTING

FLEXING:

A hose is designed to flex or bend. It is not designed to be torque or twisted. A seven (7) degree twist in a large diameter, flexing hose can reduce service life as much as ninety (90) persent.

In a flexing application, the hose line should be positioned so that the bend will open and close like a hinge. If the hose does not flex in this manner, it may be forced to take an S-bend during the movement cycle, especially when the hose is being pushed rather than bent. This S-bend type of installation produces excessive hose movement and shortens service life.

COMPILED	B.LEVINGS	SHOP PRACTICE	SECTION NUMBER 33-22227
APPRV	D.SEEMAN	AIR CONDITIONER, INSTALLATION, EVACUATION, VACUUM CHECK, & CHARGING	
ISSUE DATE	09/16/85		PAGE 1 OF 7
REV DATE	04/25/94	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	F		PA2101-04

1. PRELIMINARY:

1.1 WHENEVER THE REFRIGERATION SYSTEM OF THE AIR CONDITIONER HAS BEEN OPENED (ALWAYS RECOVER AND RECYCLE CHARGED SYSTEM), EITHER AT ASSEMBLY OR AFTER REPAIR OR REPLACEMENT OF COMPONENTS, THE SYSTEM MUST BE EVACUATED, VACUUM CHECKED, AND CHARGED.

MAKE THE FOLLOWING CHECKS BEFORE EVACUATING, CHARGING, OR LEAK TESTING THE SYSTEM:

1.1.1 CHECK FOR PROPER REFRIGERANT COMPRESSOR BELT TENSION. (REF. 33-01101 "PULLEYS AND BELTS"). ADJUST BELT TENSION IF NOT IN COMPLIANCE.

1.1.2 CHECK REFRIGERANT COMPRESSOR CLUTCH COIL WIRE CONNECTION FOR TIGHTNESS. TIGHTEN IF LOOSE. REPAIR IF BROKEN OR DAMAGED.

1.1.3 CHECK FOR BROKEN OR CUT HOSES, AND FOR LOOSE FITTINGS ON ALL COMPONENTS. REMOVE BROKEN OR CUT HOSES AND REPLACE THEM WITH NEW ONES. APPLY 48-02411-000 MINERAL OIL TO "O" RING PRIOR TO INSTALLATION. AT HOSE BUILD-UP, APPLY TWO DROPS OF MINERAL OIL TO THREADS PRIOR TO INSTALLING PROTECTIVE CAP PLUG. TIGHTEN FITTINGS IN ACCORDANCE WITH TORQUE VALUES SHOWN IN TORQUE TABLE.

A/C FITTING TORQUE TABLE

HOSE SIZE	FITTING TORQUE
#6	20-25 FT-LB
#8	30-35 FT-LB
#10/12	35-40 FT-LB

AFTER TORQUING, APPLY TORQUE SEAL TO EACH CONNECTION.

ONE INCH "O" RING FITTING ON COMPRESSOR HEAD NEEDS TO BE TORQUED 21-27 FT-LB REGARDLESS OF HOSE SIZE.

1.1.4 DEPRESS CHARGE PORT STEM AND MAKE SURE SYSTEM WAS NOT PREVIOUSLY CHARGED (NECESSARY IN OFF-LINE ONLY).

2. HOSE ASSEMBLY:

USE MINERAL OIL (48-02411-000) ON ALL AIR CONDITIONING HOSE AND FITTING("O"RING) ASSEMBLIES. HOSES SHOULD BE BLOWN OUT WITH DRY NITROGEN OR CLEAN DRY COMPRESSED AIR TO REMOVE MOISTURE AND CONTAMINATION. WHEN BLOWING OUT HOSES, OBSERVE THAT SUFFICIENT GAS IS LEAVING THE OTHER END, INDICATING THAT THE HOSE ASSEMBLY IS NOT OBSTRUCTED. ALL HOSE ENDS MUST BE CAPPED IMMEDIATELY AFTER BLOWING OUT. LUBRICATE FITTING THREADS WITH MINERAL OIL (48-02411-000) AND CAP WITH THREADED CAP PLUGS ASAP AFTER BLOWING OUT HOSES.

3. CAB AIR CONDITIONING SYSTEM EVACUATION:

3.1 CAUTION BEFORE STARTING:

RECEIVER-DRIER, AIR CONDITIONER HOSES, AND OTHER COMPONENTS LEFT OPEN TO THE ATMOSPHERE CAN ABSORB ENOUGH MOISTURE TO INCREASE THE DEHYDRATION PERIOD SEVERAL HOURS. FOR THIS REASON, ANY DRIER FOUND OPEN SHOULD BE DISCARDED AND REPLACED WITH A NEW RECEIVER-DRIER. ALL COMPONENTS LEFT OPEN MUST BE CAPPED BEFORE MOVING TO OFF-LINE OR PARKING AREA OUTSIDE THE BUILDING.

ALL VALVES IN THE CHARGING STATIONS SHOULD BE KEPT CLOSED TO PREVENT ACCUMULATION OF MOISTURE WHEN NOT IN USE.

3. CAB AIR CONDITIONING SYSTEM EVACUATION: (CONTINUED)

3.2 HOSE CONNECTION AND EVACUATION SEQUENCE FOR GENERIC MACHINE TO SHOW GENERAL PROCESS (REF. FIGURE 1):

3.2.1 CONNECT HOSES OR HOSE ADAPTER YOKE(1) TO BOTH THE DISCHARGE AND SUCTION SIDE OF THE COMPRESSOR. BE SURE HOSE ADAPTER CHECK VALVE IS ON THE SUCTION SIDE (LOW SIDE) OF THE COMPRESSOR. CHARGE WILL BE THROUGH HIGH SIDE PART.

3.2.2 TURN ON THE VACUUM PUMP AND OPEN VALVES APPROPRIATELY SO THAT THE VACCUM PUMP WILL EVACUATE THE SYSTEM.

3.3 AFTER DEHYDRATING THE SYSTEM FOR 7-8 MINUTES, ISOLATE THE PUMP FROM THE REST OF THE SYSTEM. DURING THE NEXT TWO MINUTES, THE NEEDLE SHOULD LEVEL OFF UNDER 4MM. IF THE NEEDLE LEVELS OFF ABOVE THIS POINT, THIS INDICATES THE SYSTEM IS TIGHT, BUT AN EXCESSIVE AMOUNT OF MOISTURE IS PRESENT AND MORE DEHYDRATION IS NEEDED.

3.4 THE EVACUATION PUMP SHOULD BE CHECKED PERIODICALLY FOR PROPER OPERATION. THIS CAN BE DONE FIRST BY CLOSING OFF THE PUMP CIRCUIT AND CHECKING FOR A MINIMUM EVACUATION LEVEL OF 40 MICRONS OF MERCURY. FAILURE TO REACH THIS LEVEL USUALLY INDICATES EXCESSIVE MOISTURE AND CONTAMINATION IN THE PUMP OIL.

F 3.5 THE ENTIRE EVACUATION SYSTEM, INCLUDING HOSES, CAN BE CHECKED FOR PERFORMANCE BY CLOSING VALVE (#1 ON PAGE 3). THE VACUUM PUMP SHOULD PULL THE EVACUATION SYSTEM DOWN TO A MINIMUM OF .2MM. FAILURE TO REACH THIS LEVEL INDICATES A LEAK OR EXCESSIVE MOISTURE IN THE PIPING OR CONNECTING HOSES.

3.6 MAINTENANCE PROCEDURES:

F 3.6.1 ONLY SPECIFIED HIGH VACUUM PUMP OIL SHOULD BE USED IN THE VACUUM PUMP; REFER TO MANUFACTURER'S RECOMMENDATIONS. OIL MUST BE CHANGED PERIODICALLY TO KEEP MOISTURE CONTENT DOWN AND ALLOW PUMP TO FUNCTION AT LOW VACUUM LEVEL. PUMP MANUFACTURER'S MAINTENANCE PROCEDURES SHOULD BE FOLLOWED IF MORE FREQUENT THAN MONTHLY. EACH PLANT SHOULD DETERMINE OPTIMAL OIL CHANGE SCHEDULE FOR THEIR SITUATION (HUMIDITY, ETC).

F 3.6.2 VACUUM GAUGES SHOULD BE CALIBRATED YEARLY.

4. REFRIGERANT CHARGING SYSTEM:

AIR CONDITIONER SYSTEM VACUUM MUST BE AT A LEVEL BELOW 4MM BEFORE CHARGING.

4.1 DISCONNECT VACUUM LINE - QUICK COUPLER, MANUAL VALVES, OR SOLENOID VALVES.

4.2 CONNECT CHARGE LINE - QUICK COUPLER, MANUAL VALVES, OR SOLENOID VALVES.

4.3 SUPPLY OF REFRIGERANT WILL BE CLEAN AND DRY FROM 1750 LB. TANK, 125 LB. CYLINDER, OR 50 LB. TANKS.

4.4 METERING METHOD USING WEIGHT OR VOLUME (AT A CONTROLLED TEMPERATURE) MUST BE USED.

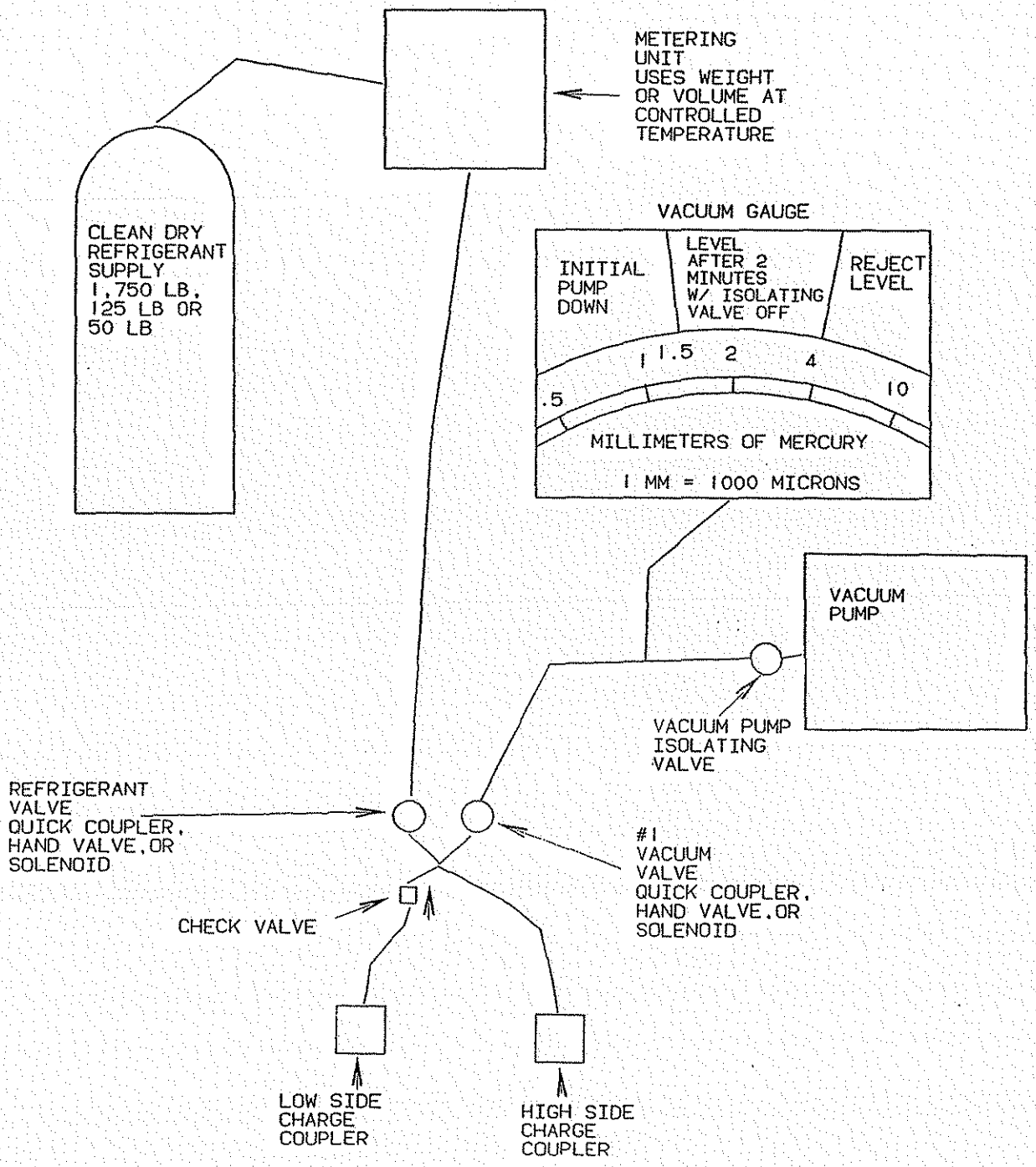
4.5 ONCE PROPER WEIGHT IS FILLED INTO AC SYSTEM, DISCONNECT CHARGE LINE.

4.6 REMOVE YOKE HARNESS FROM CHARGE PORTS.

F 4.6.1 IMPORTANT: REMOVE LOW SIDE COUPLER FIRST, THEN HIGH SIDE. A SMALL AMOUNT OF REFRIGERANT WILL EXHAUST OUT HIGH SIDE COUPLER WITH PCU YOKES. LOW SIDE PORT IS SMALLER DIAMETER THAN HIGH SIDE.

F 4.7 MONTHLY PREVENTATIVE MAINTENANCE WILL INCLUDE VERIFICATION OF CHARGE WEIGHT. ONLINE AND OFFLINE EQUIPMENT SHOULD BE USED TO EVACUATE AND CHARGE THE TEST BOTTLE. WEIGHT DIFFERENCE BETWEEN CHARGED AND EMPTY TEST BOTTLE SHOULD BE LOGGED. CORRECTIVE ACTION SHOULD BE TAKEN IF CHARGE DEVIATES ±1 OUNCE FROM NOMINAL CHARGE AMOUNT. ROTATE CHARGE SIZE EACH MONTH (I.E., TEST 2 LB. 11 OUNCE 1ST MONTH, THEN 3 LB 7 OUNCE THE 2ND MONTH AND THEN START SEQUENCE OVER).

FIGURE 1-GENERIC EVACUATION AND CHARGE STATION



5. OFFLINE REPAIR PROCEDURE:

TRUCK WILL BE RECEIVED IN THE OFFLINE AREA WITH VARIUS PROBLEMS; MISSING HOSES, SYSTEM BLOCKAGES, LEAKS, NO REFRIGERANT CHARGE, ETC.

5.1 REPAIR PROCEDURES:

5.1.1 MISSING AND UNCONNECTED HOSES AND LEAKS - CONNECT ALL HOSES AND CHECK FITTINGS FOR TIGHTNESS.

5.1.2 THE REFRIGERANT OIL IN THE A/C SYSTEM IS DIFFERENT FROM AND NON-INTERCHANGEABLE WITH THE MINERAL OIL THAT IS USED ON THE "O" RINGS AND THREADS. IF SYSTEM IS RECOVERED, REPLENISH WITH THE SAME AMOUNT OF REFRIGERANT OIL AS REMOVED. VERY LITTLE OIL WILL NORMALLY BE REMOVED FROM A/C SYSTEM DURING RECOVERY. REFER TO FREIGHTLINER SERVICE MANUAL FOR OIL QUANTITY IF UNSURE HOW MUCH OIL WAS REMOVED.

5.1.3 CONNECT YOKE OR CHARGE HOSES TO CHARGE PORTS.

F 5.1.4 EVACUATE FOR TWO(2) MINUTES, ISOLATE SYSTEM, AND LET STABILIZE. IF VACUUM STABILIZES, CONTINUE VACUUM FOR 5-6 MINUTES MORE. ISOLATE VACUUM PUMP, IF STABLE LESS THAN 4MM GO TO STEP #9. IF STABLE, BUT ABOVE 4MM, EVACUATE FURTHER UNTIL STABILIZES BELOW 4 MM, THEN GO TO STEP #9. IF NOT STABILIZING, GO TO STEP #5.

5.1.5 PRESSURIZE SYSTEM WITH 200 PSI DRY NITROGEN.

5.1.6 CHECK FITTINGS FOR NITROGEN LEAKAGE. IF LARGE LEAKS ARE PRESENT, USE THE SOAP WATER BUBBLE METHOD TO LOCATE. AFTER THE LARGE LEAKS HAVE BEEN ELIMINATED, USE AN ULTRASONIC SOUND SENSOR TO LISTEN FOR LEAKS.

5.1.7 REPLACE LEAKING "O" RINGS AND LUBRICATE WITH REFRIGERANT OIL. USE MINERAL OIL, 48-02411-000(DO NOT USE ENGINE OIL).

5.1.8 BLOCKED HOSES SHOULD BE CHECKED BY ALLOWING NITROGEN TO FLOW AND CHECKING FOR OUTPUT AT OPPOSITE END OF THE HOSE. ONCE SYSTEM IS COMPLETE, GO BACK TO STEP #3.

F 5.1.9 CHARGE SYSTEM - REFER TO 4.

5.1.10 CHECK SYSTEM FOR PROPER OPERATION. IF NECESSARY REFER TO FREIGHTLINER SERVICE MANUAL FOR FURTHER REPAIR PROCEDURES.

6. EQUIPMENT OPERATING PROCEDURES:

6.1 ROBINAIRE RECYCLE, RECOVER, AND RECHARGE EQUIPMENT:

6.1.1 CHARGE:

6.1.1.1 FOLLOW INSTRUCTIONS FOR KENT MOORE J-39500 (ROBINAIRE), EXCEPT AS FOLLOWS:

6.1.1.1.1 THESE UNITS HAVE ANALOG THERMISTOR GAUGES ADDED THAT ALLOW CHECKING DEEP VACUUM (TO STABILIZE TO LESS THAN 4.0MM AFTER A 2 MINUTE VACUUM CHECK). SET EVACUATE TIME SO AS TO GET VACUUM LEVEL NEEDED. DRY CLEAN SYSTEM SHOULD TAKE LESS THAN TEN(10) MINUTES.

6.1.1.1.2 CHARGE AMOUNT SHOULD BE SET AT CHARGE NEEDED PLUS AMOUNT RECOVERED FROM HOSE IN STEP 7.1.1.1.3.

6.1.1.1.3 PAGE 10 OF KENT MOORE MANUAL, STEPS 4-7, REPLACE WITH FOLLOWING:

6.1.1.1.3.1 TAKE LOW AND HIGH SIDE COUPLERS OFF OF TRUCK, AND DO RECOVERY CYCLE PER INSTRUCTIONS TO RECOVER R134A FROM HOSES PRIOR TO NEXT TRUCK.

6.1.1.1.4 FIFTY(50) POUND TANK HAS PARKER-HANNIFIN "NS-502-8FP" NIPPLE COMPATIBLE WITH R134 REFILL STATION.

6.1.1.1.5 CHARGE COUPLERS SHOULD BE OILED DAILY WITH 48-02411-000.

6. EQUIPMENT OPERATING PROCEDURES: (CONTINUED)

6.2 P.C.U. AND STT EQUIPMENT:

6.2.1 HOOK UP YOKE HARNESS TO TRUCK CHARGING PORTS. QUICK DISCONNECTS ARE MATCHED TO LOW AND HIGH PORTS. CHECK VALVE IS ON LOW SIDE OF YOKE HARNESS.

6.2.1.1 OIL COUPLERS DAILY WITH REFRIGERANT OIL 48-02411-000.

6.2.2 SET CHARGE AMOUNT AT CHARGE STATION.

6.2.3 BRING CHARGING TOOL (SOLENOID BOX) TO TRUCK AND HANG PREFERABLY SO YOKE HARNESS RUNS DOWN HILL TO CHARGE PORTS.

6.2.4 CONNECT YOKE TO CHARGE TOOL.

6.2.4.1 YOKE AND SOLENOID BOX CAN BE LEFT CONNECTED BETWEEN TRUCKS.

6.2.5 PUSH START BUTTON ON CHARGE TOOL.

F 6.2.6 MACHINE GOES THROUGH EIGHT(8) MINUTE VACUUM CYCLE, TWO(2) MINUTE VACUUM CHECK CYCLE, AND A CHARGE CYCLE (1.0-1.5 MINUTES). VACUUM GAUGE NEEDS TO BE MONITORED ON ONE TRUCK/SHIFT TO VERIFY THAT PRESSURE RISES AFTER EVACUATION CYCLE STARTS, DRAWS DOWN AND RISES SLIGHTLY DURING VACUUM CHECK CYCLE. THIS INSURES WE DON'T HAVE A KINK IN HOSE OR BAD SOLENIOD VALVE.

6.2.7 DISCONNECT SOLENOID TOOL FROM YOKE HARNESS(OPTIONAL).

6.2.8 LIFT YOKE ABOVE PORTS SO LIQUID FLOWS INTO TRUCK.

6.2.9 DISCONNECT YOKE ON LOW SIDE FIRST AND THEN HIGH SIDE. CAUTION: A SMALL AMOUNT OF 134A VAPOR WILL BE RELEASED SO AIM COUPLER AWAY FROM YOURSELF AND OTHERS.

7. OPERATING INSTRUCTIONS FOR R134A SUPPLY SYSTEM (REFER FIG.II)

7.1 NORMAL OPERATION - SUPPLY FROM TON TANKS

7.1.1 EITHER VALVE V4(TANK #1) OR VALVE V6(TANK#2) ARE OPEN. VALVE V5 OR VALVE V7 ARE ALSO OPEN (FILLING IS DONE FROM TANK IN USE).

7.2 SUPPLY TANK APPROACHING EMPTY - CHARGE STATION SENSES LOW PRESSURE.

7.2.1 IF SECOND TON IS READY, CLOSE VALVE V4 OR V6, WHICHEVER ONE WAS OPEN, AND OPEN THE V4 OR V6, WHICHEVER ONE WAS CLOSED. NEVER OPEN V4 AND V6 OR V8 AND V9 AT THE SAME TIME, ONLY ONE AT A TIME.

7.2.2 IF SECOND TON IS NOT READY, CLOSE VALVE V4 OR V6, WHICHEVER ONE WAS OPEN, AND OPEN V9. V8 IS ONLY OPENED IF BOTH TON TANKS AND 125 POUND TANKS ARE EMPTY AND ONLY AFTER V4, V6, AND V9 ARE CLOSED.

7.3 CHANGE OUT EMPTY TON FOR FULL TON

7.3.1 REMOVE RESIDUAL FROM TANK

7.3.1.1 IF TANK #1(#2) THEN V5(V7) SHOULD HAVE BEEN OPEN. PLACE 125 POUND OR 50 POUND EMPTY TANK (R134A ONLY - NO CONDENSIBLES OR AIR) ON FILL STATION SCALE AND CHAIN 125 POUNDER TO TANK SUPPORT. HOOK UP QUICK DISCONNECT COUPLERS. PROGRAM IN FILL WEIGHT OF 160 POUNDS OR 64 POUNDS FOR 125 OR 50 POUND TANKS RESPECTIVELY. PUSH START BUTTON ON SCALE CONTROLLER. HOT REFRIGERANT WILL FLOW TO COOLER TANK ON SCALE (FILLING WILL STOP AUTOMATICALLY ONCE PRESET WEIGHT IS MET). REMOVE FULL TANK AND REPEAT ABOVE PROCESS UNTIL FLOW OF REFRIGERANT STOPS. CLOSE VALVE V5(V7) AND OPEN V7(V5). ALLOWING TIME FOR REFRIGERANT TO COOL N 125 LB. TANKS WILL HELP RECOVER MORE REFRIGERANT OUT OF TON.

7.3.2 TAKE HEAT STRAP OFF

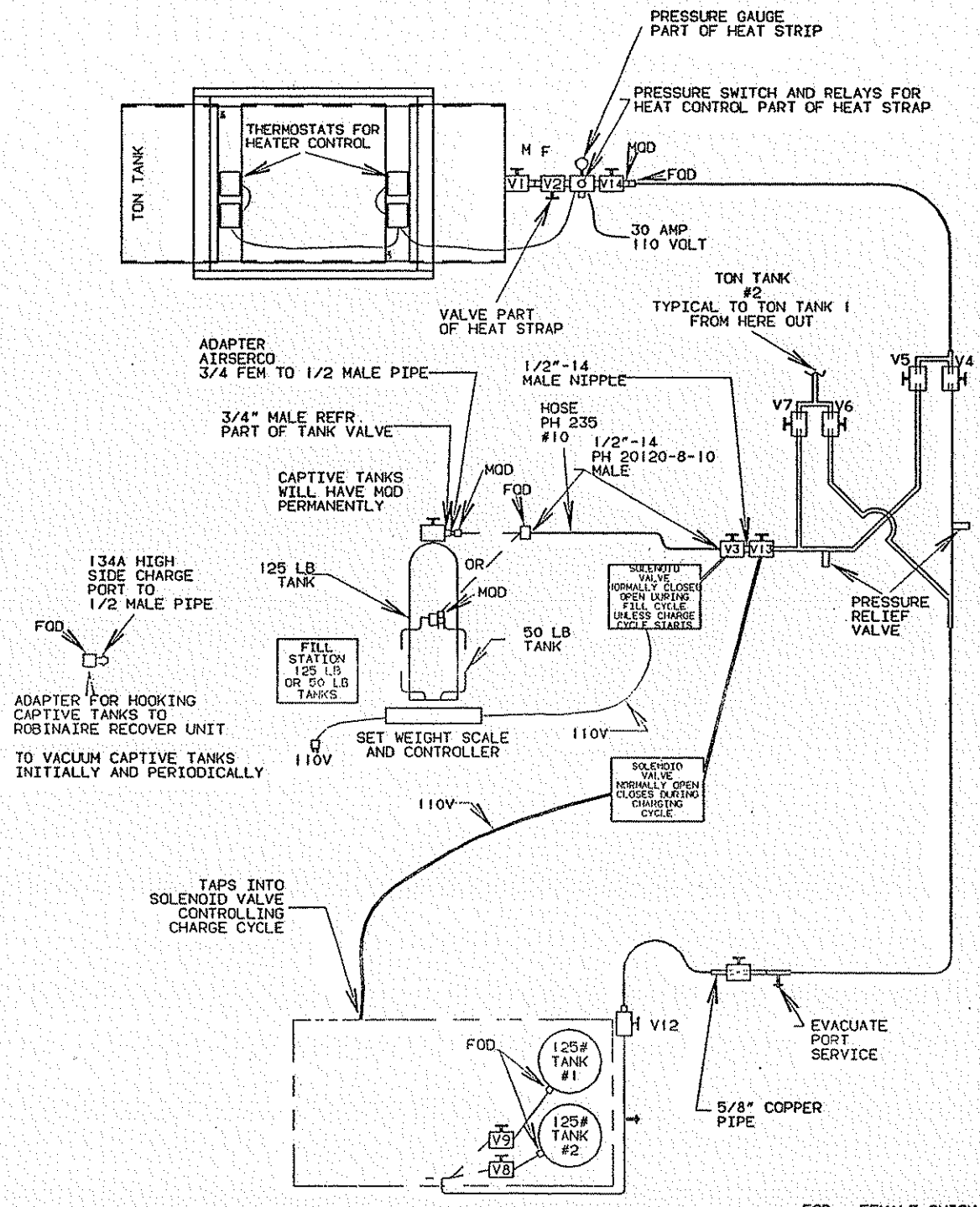
7.3.2.1 REMOVE INSULATING BLANKET. TURN VALVE V2 AND V1 (ON TON TANK) OFF. DISCONNECT 3/4 INCH REFRIGERANT COUPLING. UNCLAMP HEAT STRAPS FROM TON TANK. SET HEAT SRAP, VALVE AND HOSE ASSEMBLY SAFELY ASIDE. TURN HEAT OFF AT TIMER.

7.4 REFILL OFFLINE UNIT AND BACKUP TANKS

7.4.1 ALL 125 POUND AND 50 POUND TANKS ARE CAPTIVE AND WILL HAVE MALE QUICK DISCONNECT NIPPLES. ALL OFFLINE AND ONLINE CHARGE STATIONS WILL HAVE MATING FEMALE QUICK DISCONNECTS AS WILL THE FILL STATION. IF TANK IS EMPTY; SIMPLY PLACE TANK ON FILL STATION SCALE, CONNECT QUICK DISCONNECTS, PROGRAM PROPER WEIGHTS (SAME WEIGHT AS LISTED ABOVE FOR GETTING HEAL OUT), AND PUSH START BUTTON. FILL CYCLE CAN BE LEFT UNATTENDED.

COMPILED	B.LEVINGS	SHOP PRACTICE AIR CONDITIONER, INSTALLATION, EVACUATION, VACUUM CHECK, & CHARGING	SECTION NUMBER 33-22227
APPRV	D.SEEMAN		PAGE 7 OF 7
ISSUE DATE	09/16/85	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2101-04
REV DATE	04/25/94		
CHG LTR	F		

TON SYSTEM FOR R134A



FOD = FEMALE QUICK DISCONNECT
PH NS-501-8FP

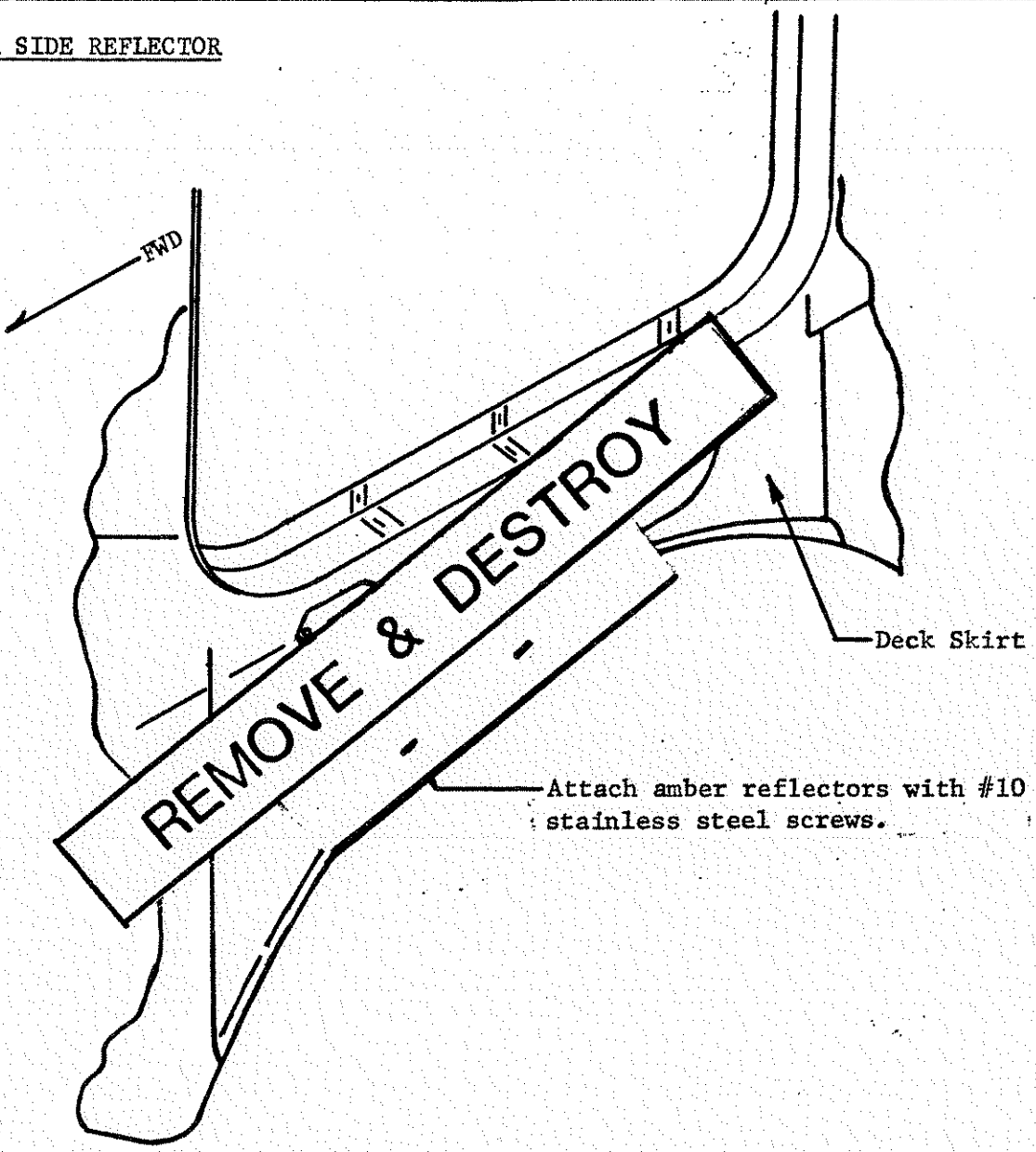
MOD = MALE QUICK DISCONNECT
PH NS-502-8FP

FIGURE II

KC 5/21/93

Compiled	A.SMITH	SHOP PRACTICE MARKER LIGHT INSTALLATION	33-22229
Approved	PHILLIPS		
Issued	10-20-75	Chg Ltr E FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-29
Revised	11-9-84		

AMBER SIDE REFLECTOR



E

Marker Lights

Attach the white ground wire, under each light, to the cab using one of the marker light mounting bolts.

E Attach the light using rivnuts and a stainless steel screw length such that the screw is flush with the end of the rivnut ± .12.

Compiled	CHOI	SHOP PRATCICE SLEEPER BOX INSTALLATION	33-22230
Approved	LOUTZENHISER		
Issued	6-17-77		
Revised	6-27-78	Chg Ltr A	Page 1

FREIGHTLINER CORPORATION
PORTLAND, OREGON

A

A. SLEEPER BOX BOOT INSTALLATION

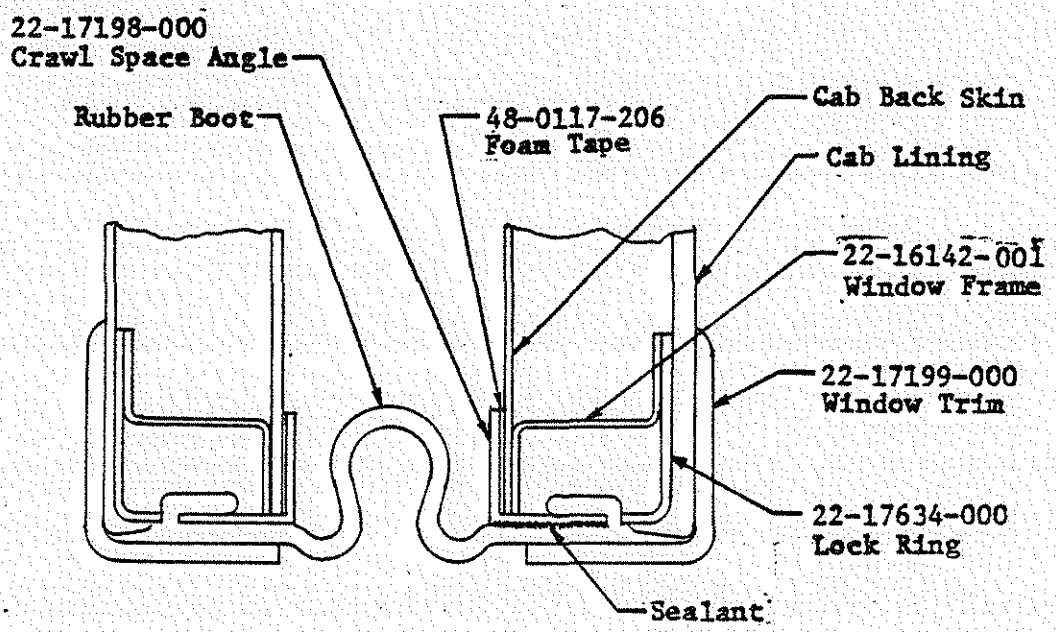
1. Use foam tape 48-0117-206 between cab back skin and 22-17198-000 angle. Align 22-16142-001 window frame and angle flush with crawl space opening and rivet together.

2. Align 22-17634-000 lock ring and 22-17198-000 crawl space angle flanges so they are flush, then temporarily mount lock ring in place using blind rivets 23-09990-004.

3. Wipe off all chips and apply sealant around flange of crawl space angle and feed rubber boot mounting flange in between crawl space angle 22-17198-000 & lock ring 22-17634-000.

4. Install cab lining A18-15148-000 and rear window trim 22-16149-000.

5. Repeat procedure when installing boot on sleeper box side.



B. SLEEPER BOX DOOR SEAL INSTALLATION

1. Thoroughly clean and dry the surfaces to which the door seal is to be applied. Use solvent to remove grease if necessary.

2. Apply adhesive (FCO/SC 1112) to the areas of the door frame where the door seal is to be installed and allowed to air dry for approximately ten minutes.

3. Apply adhesive to the areas of the door seal that fits into the door and allow to air dry for approximately ten minutes. Note that the seal must be pre-formed with 45° miter cut and cemented together as shown in figure 3.

4. No corner filler plate is needed. Remove and plug up rivet hole with caulking compound if corner plate was installed.

5. At door corners, use caulking compound to fill up gap as shown in Fig. 4.

6. On upper door latch side, apply a strip of rubber tape (48-02156-404) as in Fig. 2.

7. Apply the seal assembly to the door. Make sure that all sealing surfaces are in perfect contact and seal is oriented as in Fig. 1 and 2.

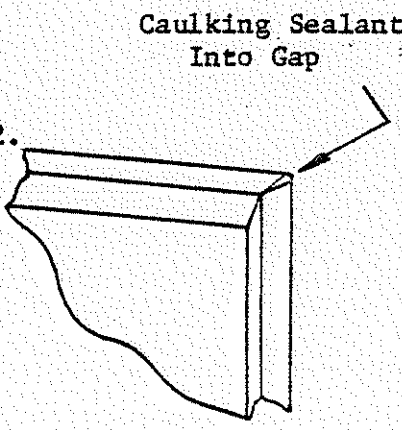


Figure 4

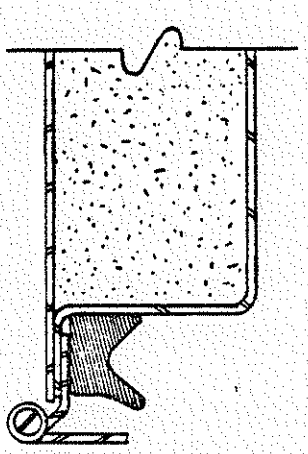


Figure 1

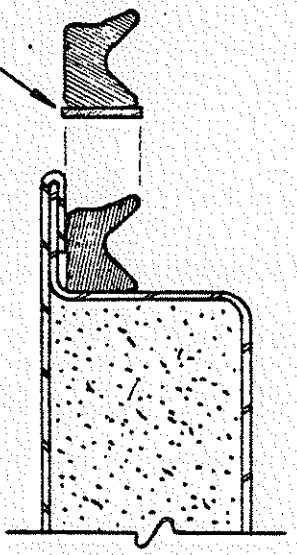


Figure 2

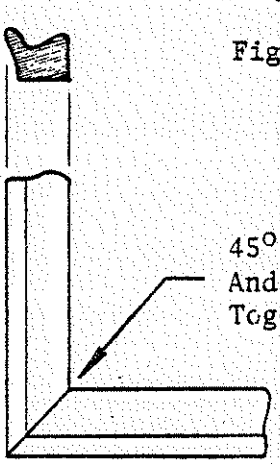
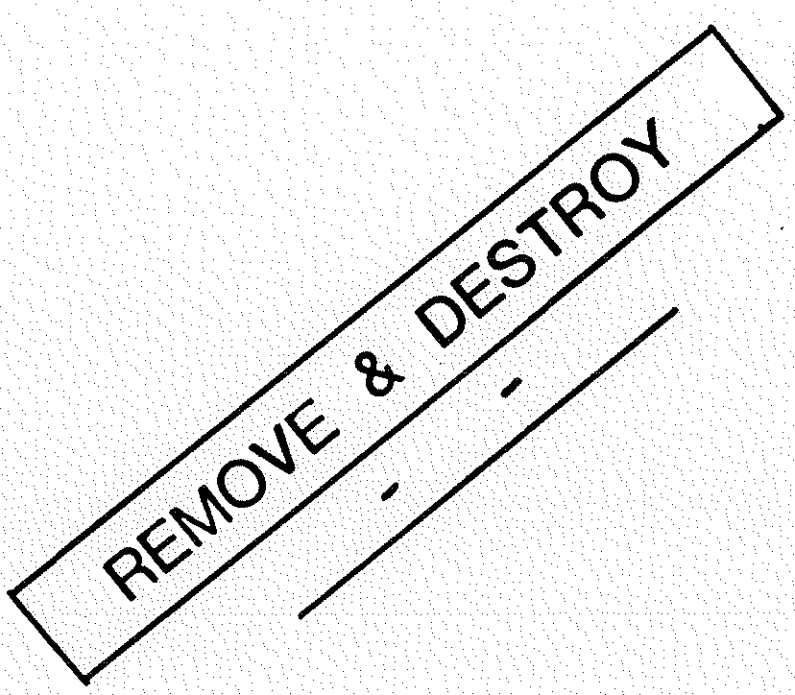


Figure 3

Compiled	G. KRANICK	SHOP PRACTICE LOW MOUNT MIRROR INSTALLATION	33-22232
Approved	E KRANICK		
Issued	11-27-78		
Revised	06/06/89	Chg Ltr B FREIGHTLINER CORPORATION PORTLAND, OREGON	

LOW MOUNT LH MIRROR

When the LH low mount mirror bracket with the double wall A-Frame bracket is specified (Ref. A22-21293-2), the lower LH A-Frame bracket is to be exchanged with the RH upper A-Frame bracket.



COMPILED	F MAXEY	SHOP PRACTICE REAR AXLE TEMPATURE GAUGE WIRE ROUTING	SECTION NUMBER 33-22234
APPRV	DJL		
ISSUE DATE	04/04/80		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	C		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-010 FOR REAR AXLE TEMP GAUGE WIRE ROUTING PROCEDURE

Compiled	F. Maxey	SHOP PRACTICE REAR AXLE TEMPERATURE GAUGE WIRE ROUTING	33-22234
Approved	[signature]		
Issued	4-4-80		
Revised	6-9-94	Chg Ltr A **FREIGHTLINER CORPORATION** **PORTLAND, OREGON**	

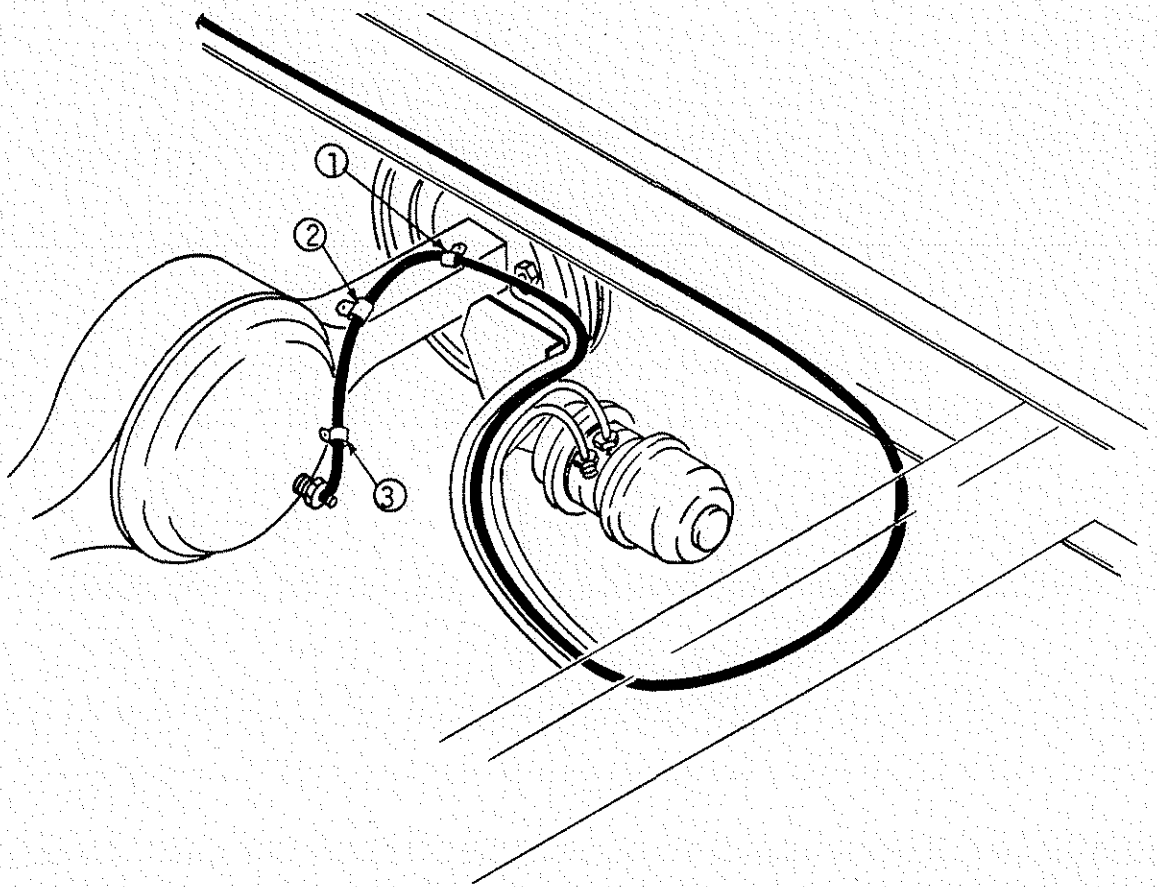
A. Axle temp sender wiring to be routed along air lines from frame to axle. Three weld studs (23-10300-4) and three insulated clamps (UMP, S325-G6) are to be used for attaching sender wire to axle as follows:

1. Outboard end of axle where the wire separates from the air lines.
2. Inboard end of the axle near the bowl.
3. On the bowl 3" from the sending unit in line with position 2.

B. Clamps are to be compressed to firmly hold the wire in place.

C. Replace the sending unit lock washer and nut with a jam nut ref (23-9337-105).

A D. Alternate methods are acceptable as long as good wire routing techniques are adhered to as outlined in Section 33-06101 of this manual.



COMPILED	S ELLISON	SHOP PRACTICE TREAD PLATE INSTALLATION	SECTION NUMBER 33-22235
APPRV	LOUTZEN.		
ISSUE DATE	01/30/84		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

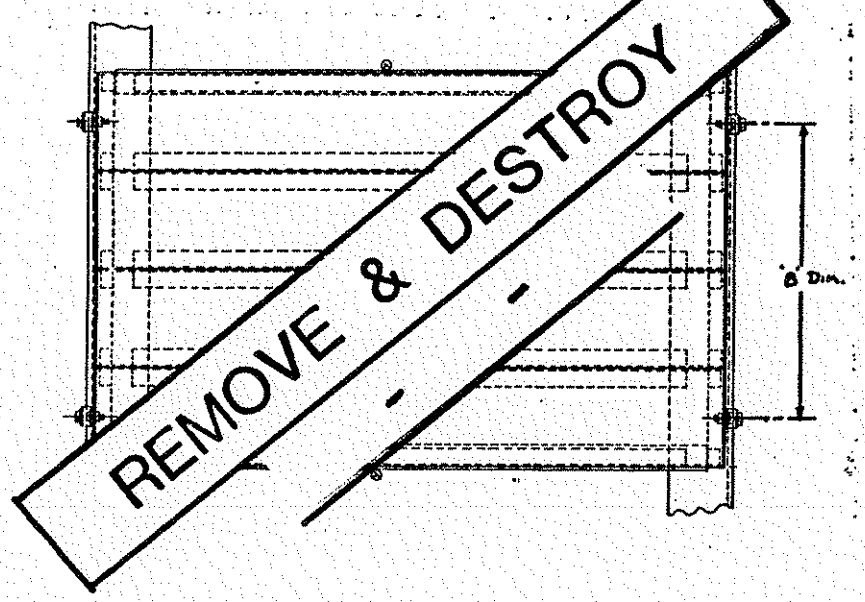
REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-011 FOR TREAD PLATE INSTALLATION.

Compiled	S. ELLISON	SHOP PRACTICE TREAD PLATE INSTALLATION	33-22235
Approved	LOUTZENHISER		
Issued	1-30-84		
Revised		Chg Ltr FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-29

1. OBSTRUCTIONS

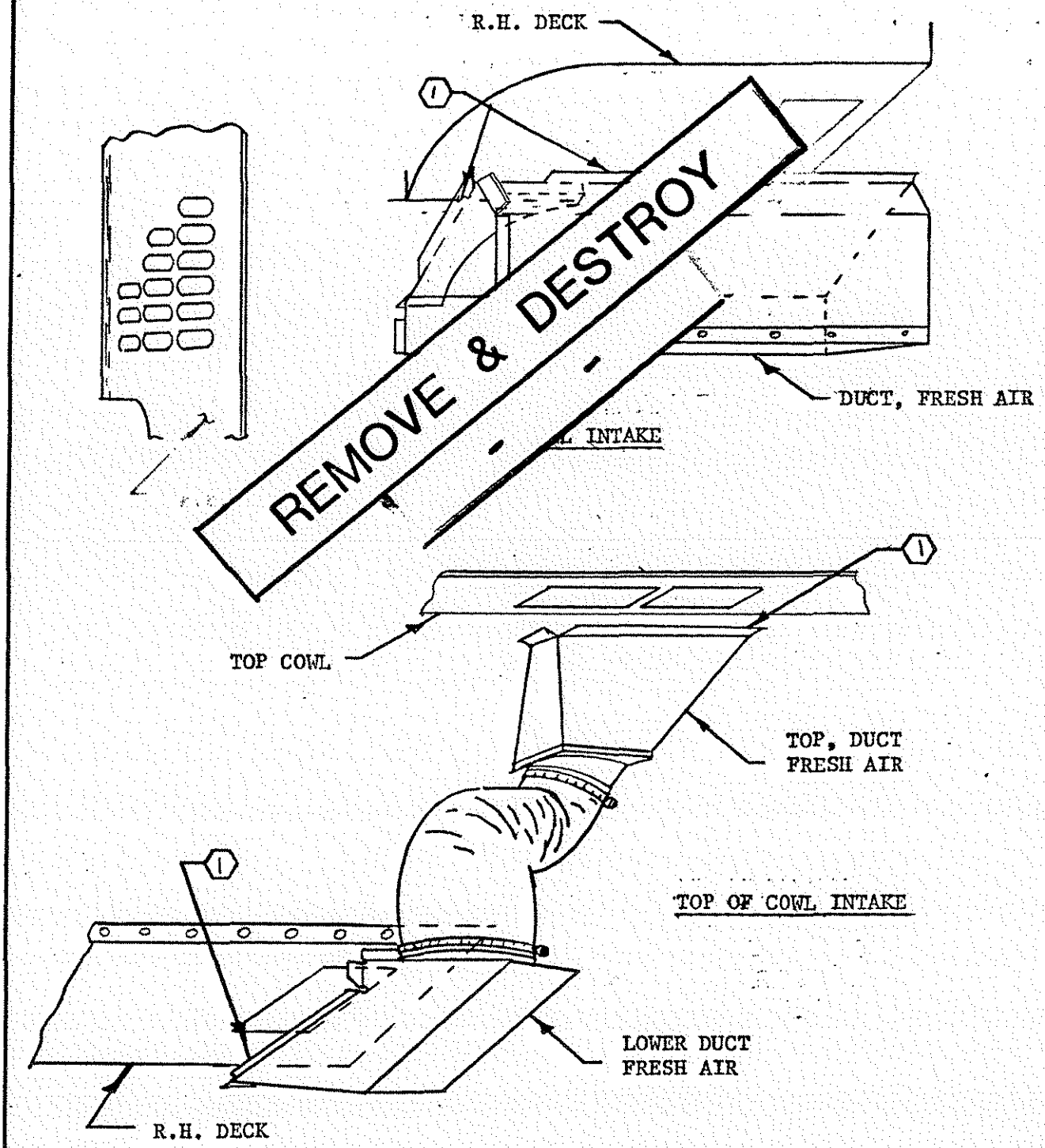
i.e., Tilt Pumps, etc.

If frame drilling spacing for tread plate hold-down holes ("A" dim. per D15-2316) is different than the "B" dimension of tread plate assembly, shown below, the shop is to install new threaded rivets in tread plate assembly so that "B" dimension is equal to "A" dimension.



Ref. Dwgs: D22-24154, A22-24153, D15-2316

Compiled	SHIMOJIMA	SHOP PRACTICE FRESH AIR INTAKE SEALING RED DOT UNDER DASH HTR-A/C, CONV.	33-22236 Page 1 of 2
Approved			
Issued	4-4-80	Chg Ltr	P*A078-29
Revised		FREIGHTLINER CORPORATION PORTLAND, OREGON	



(1) USE 48-00050-308 FOAM TAPE ON ALL FLANGES. USE 48-00118-001 CAULKING SEALANT TO SEAL ALL GAPS OR HOLES LEFT ON OR AROUND EDGES OF DUCT AFTER ASSY. & MOUNTING OF DUCT. THE DUCT MUST BE SEALED SO THAT NO EXHAUST FUMES OR OTHER GASES MAY ENTER THE CAB FROM THE ENGINE COMPARTMENT.

REMOVE & DESTROY

Compiled	GAF	SHOP PRACTICE SEAT FASTENING SYSTEMS	33-22237 Page 1 of 2
Approved	KOEPKE		
Issued	9-23-81		
Revised	1-30-84	Chg Ltr C FREIGHTLINER CORPORATION PORTLAND, OREGON	P*A078-29

To secure the seat to the deck, the following fasteners are to be used to assure compliance with applicable federal safety standards. All deviations must be approved by Corporate Engineering.

REMOVE & DESTROY

C

FOR FREIGHTLINER TUBE SEAT

P/N	ITEM	QTY
23-10744-075	Hex Capscrew, Grade 5, Plated, 5/16-18x3/4	4
23-9318-10	Lockwasher	4

FREIGHTLINER TUBE SEAT (CONT.)

	ITEM	QTY
23-10410-150	Machine Screw, Panhead, 10-24x1½	4
23-9318-007	Lockwasher, #10, Plated	4
23-9339-505	Hexnut, Plated	4

FOR AIR SUSPENDED SEATS

Install the seat and mounting plate per Location [illegible]2-25940.

REMOVE & DESTROY

COMPILED	F F	SHOP PRACTICE	SECTION NUMBER 33-22238
APPRV	F F	WINTERFRONT INSTALLATION	
ISSUE DATE	08/16/83		PAGE 1 OF 1
REV DATE	07/29/96	FREIGHTLINER CORPORATION PORTLAND, OREGON	
CHG LTR	A		PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-012 FOR WINTERFRONT INSTALLATION PROCEDURE.

Compiled	F. FREER	SHOP PRACTICE WINTERFRONT INSTALLATION	33-22238
Approved	[signature]		
Issued	8-16-83		
Revised		Chg Ltr	

FREIGHTLINER CORPORATION
PORTLAND, OREGON

WINTERFRONT INSTALLATION

If a winterfront is specified on a vehicle also specifying a snap-on bug screen one of the items should be shipped loose. They can not both be installed on the grille.

COMPILED	RAY	SHOP PRACTICE LEAK CHECK, A/C SYSTEM	SECTION NUMBER 33-22239
APPRV	BMW		
ISSUE DATE	03/16/94		
REV DATE	07/29/96		PAGE 1 OF 1
CHG LTR	A	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2042-72

REFER TO IMIS (INTEGRATED MANUFACTURING INFORMATION SYSTEM) WORK INSTRUCTION K09-S0022-013 FOR LEAK CHECK, A/C SYSTEM PROCEDURE.

COMPILED	RAY	SHOP PRACTICE	SECTION NUMBER 33-22239
APPRV	BWM	LEAK CHECK, A/C SYSTEM	PAGE 1 OF 2
ISSUE DATE	03/16/94	FREIGHTLINER CORPORATION PORTLAND, OREGON	PA2101-03
REV DATE	/ /		
CHG LTR	-		

PURPOSE

TO DETECT THE LEAKAGE OF R-134A REFRIGERANT ON ALL VEHICLES EQUIPPED WITH AIR CONDITIONING UNITS, USING AN APPROVED HAND HELD LEAK DETECTION UNIT IN THE CUSTOMER READY CHECK BUILDING.

PROCEDURE

THIS PROCEDURE IS SET UP WITH THE CPS L-790A DETECTOR ONLY. THE CPS L-790A WILL DETECT REFRIGERANT LEAKS WITH A RATE OF 15 GMS/YEAR IF SET UP PROPERLY. THE UNIT WILL ACCURATELY DETECT R-12, R-22, AND R-502 REFRIGERANTS AS WELL AS R-134A.

1. PRE-CHECK PROCEDURE

1.1 CHECK THE CPS L-790A DETECTION UNIT FOR A LOW BATTERY INDICATION. CHANGE BATTERIES IF REQUIRED.

1.2 CHECK TO INSURE ALL PARTS OF THE DETECTOR ARE PRESENT AND ARE CONNECTED PROPERLY. THIS INCLUDES THE MAIN BODY, THE ION SENSOR CARTIDGE, ALUMINUM SENSOR HOUSING, WATER VAPOR REFERENCE FILTER, AND EARPHONE IF REQUIRED.

1.3 START VEHICLE AND RUN A/C SYSTEM FOR ONE (1) MINUTE. SHUT VEHICLE OFF AND PROCEED.

2. LEAK DETECTOR SET UP

2.1 DETERMINE SENSITIVITY LEVEL REQUIRED FOR ACCURATE READINGS. USING THE CPS L-790A LEAK DETECTION UNIT, DO NOT INITIALLY SET THE SENSITIVITY LEVEL GREATER THAN FIVE (5)-OTHERWISE A LARGE NUMBER OF RANDOM FLUCTUATIONS WILL BE PRESENT. ONLY USE LEVELS HIGHER THAN FIVE (5) TO PINPOINT A LEAK AFTER INITICAL DETECTION. THE LOCK-OUT MODE IS ALSO USEFUL IF A LARGE LEAK IS PRESENT AND PINPOINTING THE LOCATION IS STILL REQUIRED.

2.2 SET UNIT TO INDICATE LEAKS WITH BOTH VISUAL AND AUDIBLE ALRMS USING APPROPRIATE INPUTS ON THE KEY PANEL.

3. LEAK CHECK

3.1 USING THE HAND HELD CPS L-790A REFRIGERANT DETECTION UNIT, CHECK FOR LEAKS BY PLACING THE ALUMINUM HOUSING NEAR THE SUSPECTED AREA, WITH SPECIAL ATTENTION ON THE AREA BELOW THE FITTING OR JOINT BEING CHECKED (R-134A IS HEAVIER THAN AIR)

OGON ID=

3.2 IF A LEAK IS SUSPECTED, VERIFY LEAK BY REMOVING THE SENSING UNIT FROM THE IMMEDIATE AREA, THEN RETURNING IT TO THE SAME SPOT. SIMILAR REFRIGERANT LEAK RATE READINGS SHOULD BE INDICATED ON THE DETECTION UNIT IF A LEAK IS PRESENT.

3.3 BEGIN THE VEHICLE A/C SYSTEM CHECK UNDERHOOD, CHECKING THE A/C COMPRESSOR AND FITTINGS, CONDENSER, RECEIVER/DRYER, SPLICER PLATE, AND ANY NON-CONTINUOUS HOSE CONNECTIONS. ANY CONNECTION USING O-RING SHOULD BE THOROUGHLY CHECKED. RECORD ANY DETECTED LEAKS ON THE APPROPRIATE PAPERWORK STATING AND/OR SHOWING THE REFIGERANT LEAK LOCATION.

3.4 PROCEED TO THE INTERIOR OF THE VEHICLE AND CHECK ALL INTERNAL FITTINGS BEHIND DASH AND IN SLEEPER AREA (IF APPLICABLE) BY PLACING DETECTION SENSOR BELOW THE DASH PANEL AND CHECKING READINDS AT THAT POINT. ANY LEAKAGE IN THE EVAPORATOR, EXPANSION VALVE OR ANY JOINT/FITTING WILL BE DETECTED BY THE UNIT. IF A LEAKAGE IS FOUND, RECORD READINGS ON PAPERWORK. PINPOINTING THE LEAK BEHIND THE DASH PANEL WILL BE DONE BY OFFLINE PERSONNEL. ALSO CHECK EVAPORATOR FITTINGS UNDER DECK FOR AUXILLARY HVAC UNITS.

4. RECORDING

4.1 IN AN EFFORT TO IMPROVE OVERALL SYSTEM PERFORMANCE AND RELIABILITY IT IS IMPORTANT TO ACCURATELY RECORD THE LOCATION AND SEVERITY OF THE DETECTED LEAK. THE VISUAL INDICATORS ON THE CPS L-790A SHOW A LEVEL OF SEVERITY THAT CAN BE USED WHEN RECORDING LEAKS (ALSO STATE SENSITIVITY LEVEL). LOCATION DESCRIPTIONS SHOULD BE DETAILED TO AVOID ANY CONFUSION. IF A LEAK IS DETECTED,THE INFORMATION IS TO BE FORWARDED TO THE OFFLINE DEPARTMENT. OTHERWISE, THE INFORMATION IS TO BE COLLECTED BY THE QA DEPARTMENT FOR ANALYSIS.

PRECAUTIONS

ABOVE PROCEDURE IS SET UP FOR THE CPS L-790A DETECTOR ONLY. ANY DETECTORS PREVIOUSLY PROCURED FOR THE OFFLINE DEPARTMENT ARE NOT ACCEPTABLE FOR THE ACCURATE DETECTION OF R-134A REFRIGRANT AND SHOULD BE LABLED AS SUCH.

Compiled		SHOP PRACTICE	M33-23100
Approved		GENERAL USE COMPONENTS	Contents
Issued	4/7/65	FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised	1-1-68		

NOTE: For designation and specification only; for application and adjustment, see M33-00-Series.

GROUP & TOPIC NO.	DESCRIPTION	LAST REV.
23-101	LUBRICANT SPECIFICATIONS	
-102	FASTENERS	
-103		
-104		
-105		
-106	TUBING	
-107	BOOTS, CAPS & COVERS	5/65
-108		
-109		
-110		
-111	HYDRAULIC FLUIDS	
-112		
-113	PRIMERS & PAINTS	
-114	SEALANTS	10/65
-115	ANTI-CORROSION COMPOUNDS	10/65
-116	UNDERCOAT	
-117	ADHESIVES	
-118	ANTIFREEZE	
	USE OF FRAME WASHERS	15104 00106
	FOR	SEE

Form E-45 REPORT ERRORS & CHANGES TO ENGINEERING DEPT.

General

Fasteners used for all vehicle applications shall conform to S.A.E. standards, unless specified otherwise by Engineering.

Threaded Fasteners

A. Bolts, screws, nuts and the like, whether obtained commercially or produced by Freightliner, shall conform to the Unified Screw Thread Standard, Coarse or Fine Thread Series, Grade 5 Material, unless specified otherwise.

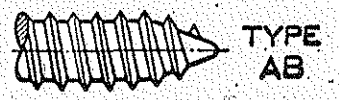
Class 2 tolerances for thread dimensions (i.e., "Class 2 fit") will apply in all cases to both outside and inside threaded members.

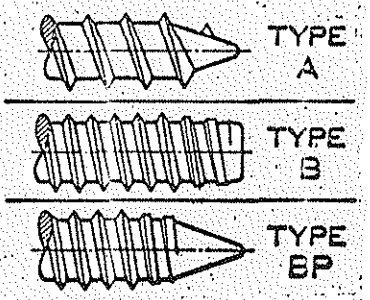
A For nominal sizes of 7/16 and up, through-bolts with nuts shall be of the
A UNF series, and cap screws or studs entering tapped holes shall be of the UNC series. Smaller sizes than 7/16 may be selected in either UNF or UNC series.

B. Tapping Screws (ref. ASA Type & Thread Form)

Type AB tapping screws are to be used instead of type A or type BP tapping screws.

Type B tapping screws are to be used when a blunt end is required.





C. Prevailing torque locknuts are assigned three grades A,B, and C, by the American Standards Association. Locknut grades shall be used with the following bolt grades:

A.S.A. Locknut Grade	S.A.E. Bolt Grade
A	0,1,2
B	3,4,5
C	6,7,8

D. Lockwashers

B Lockwashers are not to be used adjacent to aluminum surfaces.

The following rivets are normally stocked for Freightliner shop use:

78° FLAT COUNTERSUNK HEAD
AN 425 6053 T61

AN 425-4- 4	1/8 x 1/4
AN 425-5- 4	5/32 x 1/4
AN 425-5- 5	5/32 x 5/16
AN 425-5- 6	5/32 x 3/8
AN 425-5- 7	5/32 x 7/16
AN 425-5- 8	5/32 x 1/2
AN 425-5- 9	5/32 x 9/16
AN 425-6- 6	3/16 x 3/8
AN 425-6- 7	3/16 x 7/16
AN 425-6- 8	3/16 x 1/2
AN 425-6- 9	3/16 x 9/16
AN 425-6-10	3/16 x 5/8
AN 425-6-12	3/16 x 3/4
AN 425-6-16	3/16 x 1
AN 425-6-20	3/16 x 1 1/4
AN 425-8-10	1/4 x 5/8
AN 425-8-12	1/4 x 3/4

ROUND HEAD
AN 430 6053 T61

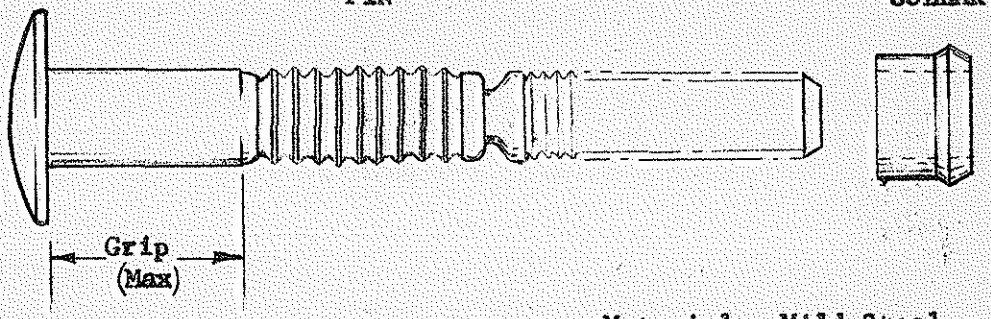
AN 430-8- 8	1/4 x 1/2
AN 430-8-10	1/4 x 5/8
AN 430-8-12	1/4 x 3/4
AN 430-8-14	1/4 x 7/8
AN 430-8-16	1/4 x 1

BRAZIER HEAD
AN 455 6053 T61 Chamfered Shank

AN 455-5- 5	5/32 x 5/16
AN 455-5- 6	5/32 x 3/8
AN 455-5- 7	5/32 x 7/16
AN 455-5- 8	5/32 x 1/2
AN 455-5-10	5/32 x 5/8
AN 455-5-12	5/32 x 3/4
AN 455-6- 5	3/16 x 5/16
AN 455-6- 6	3/16 x 3/8
AN 455-6- 7	3/16 x 7/16
AN 455-6- 8	3/16 x 1/2
AN 455-6- 9	3/16 x 9/16
AN 455-6-10	3/16 x 5/8
AN 455-6-12	3/16 x 3/4
AN 455-8- 8	1/4 x 1/2
AN 455-8-10	1/4 x 5/8
AN 455-8-12	1/4 x 3/4
AN 455-8-14	1/4 x 7/8

BRAZIER HEAD
25 F Soft

AN 455-5- 5	5/32 x 5/16
AN 455-5- 6	5/32 x 3/8
AN 455-5- 7	5/32 x 7/16
AN 455-5- 8	5/32 x 1/2
AN 455-5-12	5/32 x 3/4
AN 455-6- 8	3/16 x 1/2



Material: Mild Steel

PIN NUMBER *	NOM. DIA. INCHES	GRIP RANGE (INCHES) MIN.	GRIP RANGE (INCHES) MAX.	RECOMMENDED HOLE DIAM. (INCHES)	COLLAR NUMBER	AVERAGE STRENGTH SHEAR (LBS)	AVERAGE STRENGTH TENSION (LBS)
RR6B-R8-4	1/4	.219	.344	17/64	2LC-R8	3500	3200
RR6B-R8-6	3/8	.344	.469	17/64	2LC-R8	3500	3200
RR6B-R8-8	1/2	.469	.594	17/64	2LC-R8	3500	3200

Installation Tools:

Huck Installation tool #353 has been found satisfactory for Freightliner shop use. Other types and models are available from Huck Mfg. Co. (2500 Bellvue, Detroit 7, Mich. or 220 N. Daphne, Hawthorne, Calif.) or from the Cherry Rivet Division of Townsend Company.

* Example of Pin Part Number: RR6B-R8-6

- SERIES (Multigrip) — RR6B
- NUMBER OF LOCK GROOVES — RR6B
- HEAD STYLE (B=Brazier) — RR6B
- MATERIAL (R= Mild Steel) — R8
- DIAMETER (32nds of inch) — 6
- GRIP LENGTH (16ths of inch) — 6

Townsend Co., Engineered Fasteners Division, Ellwood City, Pa.
Western • 1224 E. Warner Avenue, Santa Ana, Calif. 92705

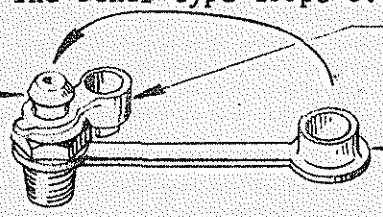
Compiled	H.J.R.	SHOP PRACTICE BOOTS, CAPS & COVERS	M33-23107
Approved	[illegible]		
Issued	5/11/65	FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised	1/12/68		

In general, the use of special boots, caps and covers to protect working parts of the vehicle is to be discouraged. It is far preferable that parts be so designed and so mounted that they are self-contained and protected without the use of auxiliary devices. There are, however, some allowable exceptions. Some of these are:

Lube-Fitting Caps

A small cap, flexibly tethered* to the fitting by a thin strap with a ring at its end, all molded in plastic, is used at each Zerk lubrication fitting on the vehicle.

One type will be included at the time the lube fitting is installed, the ring simply being slipped over the threaded portion of the fitting before screwing the fitting in place. However, the plastic ring can readily be slipped over the fitting afterward. The other type loops over the tip after the fitting is installed.



The purposes of this cap are at least twofold:

(a) It serves to exclude from the tip of the fitting dirt which otherwise might be forced in with the lubricant by the lube gun.

(b) It can be used as an indicator at vehicle assembly that the fitting has been lubricated, if the cap is left open until the fitting has been greased.

* CLV #PO 18 - A patented product of Clover Industries, Inc., Plastic Division, 578-602 Young Street, Tonawanda, New York.
PRC #B391 -- A product of Protective Closures, 2207 Elmwood Ave., Buffalo, N.Y.

Compiled	M.J.R.	SHOP PRACTICE MATERIAL SPECIFICATIONS	33-48100 Contents
Approved	M.J.R.		
Issued	9-23-68		
Revised	4-5-74	Chng Ltr: C FREIGHTLINER CORPORATION PORTLAND, OREGON	

NOTE: For designation and specification only; for application and adjustment, see 33-00-Series.

	GROUP & TOPIC NO.	DESCRIPTION
C	48-	[illegible]
	-102	
	-103	
	-104	
	-105	
	-106	TUBING
	-107	
	-108	
	-109	
	-110	
B	-111	
	-112	
A	-113	
	-114	SEALANTS
	-115	ANTI-CORROSION COMPOUNDS
	-116	PROTECTIVE COATINGS, NON-METALLIC
	-117	ADHESIVES
	-118	ANTIFREEZE
	-119	INSULATION
	-120	

	FOR	SEE
B A	HYDRAULIC FLUIDS PRIMING & PAINTING	33-14106 & 33-18120 33-00113

FREIGHTLINER APPROVED LIST

Usage	Product
Brown-Lipe gear boxes	SAE 50, Straight run or blended mineral oil. (Anti-foam and anti-oxidation agents permissible, but no detergent agents.)
Ingersoll-Rand air starters w/optional automatic oiling system	#2 Diesel Oil
w/o optional automatic oiling system	Not specified
Steering Chuck	SAE 90 MP gear lube (10° F & up) -- SAE 75 MP gear lube (continuous below 10° F)
Wheel Bearings:	Grease to meet Spec 0-610 established by Transmission & Axle Division of Rockwell Standard Corp. and defined in Field Maintenance Manual #1, "Lubrication".

Engines:

Ambient Temperature (°F)	Specification	Viscosity Grade
All Cummins Engines		
Above 20°	Mil-L-2104B	SAE 20
Below 20°	Mil-L-2104B	SAE 10W
All Detroit Diesel Engines		
All Temperatures	Mil-L-2104B	SAE 30
All Caterpillar Engines		
Above 32°	Mil-L-45199	SAE 30
Below 32°	Mil-L-45199	SAE 10W-30
All Allis-Chalmers Engines		
Above 32°	Mil-L-45199B	SAE 30
0° - 32°	Mil-L-45199B	SAE 20
Below 0°	Mil-L-45199B	SAE 10W

For application data, see 33-00-Series

Renumbered: was 33-23101

Compiled		SHOP PRACTICE	33-48106
Approved		TUBING	
Issued	9-23-68	FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised			

FREIGHTLINER APPROVED LIST OF PLASTIC TUBING

(For installation see 00106)

USAGE	PRODUCT/MANUFACTURER
Air supply, horn and windshield wiper Overflow tube, radiator	Polypenco Nylaflow, Type LP - Polymer Corp. of Pennsylvania 2150 Fairmont Avenue, Reading, Pennsylvania Imperial-Eastman, Nylon II SN - Imperial-Eastman Corp. Dept. TR, 6300 W. Howard St. Chicago 48, Illinois

Renumbered; was 33-23106.

Compiled	H.J.R.	SHOP PRACTICE HYDRAULIC FLUIDS	33-48111
Approved	H.J.R.		
Issued	9-23-68	Chng Ltr: A FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised	9-18-72		

1. POWER STEERING APPLICATIONS

Use 10W-MS Engine Oil

2. TILT PUMP APPLICATIONS

A. For temperatures -10°F. and above, fill with any of the following:

(a) RPM Torque Fluid No. 3
(b) Mobil Fluid 62
(c) Donax T-1
(d) Enco Torque Fluid 35
(e) Texaco 764 Torque Fluid 60

Acceptable alternate: Automatic Transmission Fluid (Type A)

A

B. For temperatures below -10°F., fill with Aircraft Hydraulic Oil MIL-H-5606A, or equivalent.

Renumbered; was 33-23111.

FREIGHTLINER APPROVED LIST OF PRIME TREATMENTS

(BEFORE PAINTING)

After sanding, apply solvent wash (DuPont T3812 Primer Reducer) for removing grease, then follow with appropriate treatment below:

F.L. NO.	Spec.No.	Description of Treatment	Degree of Protection				Relative Cost	
			Ferrous Alloys		ALUM.	MAG.	Small Qty.	Large Qty.
			Atmos. Temp.	Elevated Temp.				
* 2	818-012 DuPont	Wash Primer	Fair		Fair*	Fair to Good	Low	Low
4	Oakite 33	Phosphoric Acid Etch			Good		Very Low	Very Low
5	818-012 DuPont - - - 65-3055 DuPont	Wash Primer - - - Poly Vinyl Butyral	Medium		Medium	Fair	Modest	Modest
7	Oakite 33 583 DuPont	Phosphoric Acid Etch Epoxy Chromate Non-Sanding Primer			Good	Fair	Low	Low
10	Mil. C-5541 - - - 583 DuPont	Amorphous Chromate Conversion coating - - - Epoxy Chromate			Good	Fair	High	Modest

Renumbered; was 33-23113.

* For Magnesium;
#7 or #10 preferred for Aluminum.

The following brands of heat resistant aluminum paint have been approved for exhaust fitting and other high temperature uses:

MANUFACTURER'S:			TEMPERATURE	REMARKS
Brand Name	Symbol	Number		
Rustoleum	RST	4115	400°F-500°F	
		4215	800°F	
		4315	1200°F	Must be clean metal and baked at 450°F for 45 minutes.
Du Pont	DUP	354-Y-794	800°F	

FREIGHTLINER APPROVED LIST OF SEALANTS

(For method of use, see 00114)

Unless specifically indicated to the contrary, all manufactueres' instructions are to be observed in the use of these products.

USAGE	PRODUCT/MANUFACTURER
1. Pipe Threads (Taper) incl: Aluminum, Brass, and Steel Fittings.	ANTI-SEIZE COMPOUNDS (Paste or Fluid except as noted.) - Armite Led-Plate #250 Armitite Industries (ALK) 1845-49 Randolph Street Los Angeles, California - Never-Seez Never-Seez Compound Corp. (NSC) Chicago, Illinois - Loctite Anti-Seize Compound Loctite Corporation (LOC) 705 N. Mountain Road Newington, Connecticut - "Bakerseal" Thread Seal & Lubricating Teflon Compound (white) #899-21 Baker Oil Tools Inc. (BKR) Los Angeles 54, California - "No-Weld No. 1" - Keystone Div., Penwalt Corp (KEY) * - Scotch Brand Pipe Thread Sealant Minnesota Mining & Mfg. Company 2501 Hudson Road (MMM) St. Paul, Minnesota 55119 * - Thread-Seal (Teflon) W.S. Shamban & Company (WSS) Culver City, California & Fort Wayne, Indiana - Tape Dope (Teflon) Hercules Chemical Co., Inc. (HCS) 84 Fifth Avenue New York City, N.Y. *Tape

Renumbered; was 33-23114 p.1. B

A

USAGE	PRODUCT/MANUFACTURER
2. Caulking Closure of moderate-size gaps and holes; General use in unexposed locations.	CAULKING COMPOUNDS, NON-HARDENING ("Gunk", "Dum-Dum", "Rub-Dub", etc.) - Mortite J. W. Mortell Company Detroit, Michigan
3. Gaskets Static seals up to 300° F.	GASKET FORMING COMPOUNDS - Permatex #2 "Form-A-Gasket" Permatex Company Dept. TR, Flagler Court Bldg. West Palm Beach, Florida - Locktite Plastic Gasket Locktite Corporation 705 N. Mountain Road Newington, Connecticut

Renumbered; was 33-23114 p.2.

USAGE	PRODUCT/MANUFACTURER
4. Heater Hoses	HOSE-TO-TUBE SEAL None: Do not use Sealant; lubricate with plain or soapy water for ease of assembly.
5. Lap Joints Cab skin-toskin and skin-to-deck lap joints; also sealing marker light rubber footing to cab roof and windshield-molding to windshield-opening.	LAP JOINT SEALANT, METAL-TO-METAL, RUBBER-TO-METAL, RUBBER-TO-GLASS, ETC. MASTIC OR PUTTY - Kent Auto Bedding Glazing Compound Kent Industries Detroit, Michigan TAPE - Behr Manning Co. Troy, New York
6. Screw Threads (Straight) Screws and nuts that must not loosen under vibration. Studs that require greater break-loose torque than Class 5 Force Fit when set. Set screws, capscrews, machine screws. (Screws that may require occasional adjustment or replacement)	SCREW & NUT LOCK COMPOUNDS - Locktite Nut Lock - Locktite Stud Lock - Locktite Screw Lock Locktite Corporation 705 N. Mountain Road Newington, Connecticut
7. Windshield Glass to Windshield Molding	WINDSHIELD SEALER - Bear Brand Windshield Sealer Behr-Manning Company Troy, New York - Kent Auto Bedding Glazing Compound Kent Industries Detroit, Michigan
8. Flexible Weather Seal: Metal-to-Metal and Wire Entry Sealing	SILICONE RUBBER ONE-PART SEALER - #780 Building Sealant Dow Corning Corporation Midland, Michigan

Renumbered; was 33-23114 p.3.

Compiled	W.J.A.	SHOP PRACTICE	33-48115
Approved	W.J.R.	ANTI-CORROSION COMPOUNDS	
Issued	9-23-68	FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised			

FREIGHTLINER APPROVED LIST OF PRODUCTS

USAGE	PRODUCT/MANUFACTURER
To Prevent Corrosion of Metal Spread on all surfaces where two different metals such as steel and aluminum, steel and magnesium, etc., come together. Use especially between frame and brackets, under washers and bolt heads attaching aluminum and magnesium parts, and where brackets attach to cab structure.	ANTI-CORROSION COMPOUNDS Alumilastic "C" Consistency Parr Paint & Color Co. Cleveland, Ohio
Rust Prevention General	Rust Preventives ENSIS-105 Shell Oil Co.
Rust Prevention Cylinder blocks, cylinder heads, cranks, etc.	Ferrocrate 346 (Petroleum Solvent Base) Quaker Chemical Products Corp. Conshohocken, Pennsylvania
To Prevent Acid Corrosion of Battery Box (Plywood) Liner	Compound "L" Texaco

Renumbered; was 33-23115.

Compiled	P.M.R.	SHOP PRACTICE	33-48116
Approved		PROTECTIVE COATINGS, NON-METALLIC: UNDERCOAT	
Issued	9-23-68	FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised			

APPROVED LIST OF UNDERCOAT MATERIALS*

USAGE	PRODUCT/MANUFACTURER
General use undercoating of cab deck and tunnel, inside of door panels, etc., for surface protection, sound deadening and heat insulation.	PERMANENT UNDERCOAT - Quaker Koat Quaker State Oil Refining Company of California - Nox-Rust (=Empire Lubricants Part No. AC410) (New Super Nox-Rust Undercoating fortified with 5XL) Daubert Chemical Co. of Chicago, Los Angeles and Philadelphia

Renumbered; was 33-23116.

* For detailed usage and methods of application see 33-00116.

Compiled	H.P.R.	SHOP PRACTICE	33-48117
Approved		ADHESIVES	
Issued	9-23-68	FREIGHTLINER CORPORATION PORTLAND, OREGON	
Revised			

APPROVED LIST OF ADHESIVES
(For Method of Use See 00117)

	MATERIAL(S) TO BE JOINED	ADHESIVE AGENT & MANUFACTURER
1.	"Royalite"	Solvent Methyl-ethyl-ketone (M-E-K) (for softening the surfaces to be joined.) Chemical supply house
2.	Rubber, Polyurethane foam, fabric and leather to metal, wood, and many plastic surfaces.	Rubber-Base Adhesive EC 1711 High Strength Rubber-Based Adhesives. (Excellent resistance to water.) Adhesives, Coatings & Sealers Div. 3-M Co., St. Paul, Minnesota
3.	Rubber to Metal	Adhesive Weatherstrip Adhesive (Black) 3-M Brand Adhesives, Coatings, & Sealers Div. 3-M Co, St. Paul, Minnesota
4.	Vinyl & Cloth Trim	Adhesive Fast Tack Adhesive 3-M No. 8035 Adhesives, Coatings, & Sealers Div. 3-M Co., St. Paul, Minnesota

Renumbered; was 33-23117.

Compiled	HEILESON
Approved	ROLLINS
Issued	4-8-74
Revised	

SHOP PRACTICE
ANTIFREEZE

33-48118

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FREIGHTLINER CORPORATION
PORTLAND, OREGON

It is Freightliner policy to install antifreeze in all vehicles unless specifically authorized otherwise. The antifreeze must be approved per Freightliner material specification 48-22880 and be installed in accordance with the following compatability listing between engine manufacturers, water filter elements, and cooling system inhibitors and/or antifreeze.

ENGINE MODEL COMPATIBLE WITH:	FILTER ELEMENT/ INHIBITOR WITH:	COOLING SYSTEM MEDIUM
ALLIS CHALMERS	CHROMATE	Ethylene Glycol
		Dowtherm 209
		Water
	BORATE	Ethylene Glycol
		Water
	DCA	Ethylene Glycol
		Water
CATERPILLAR	BORATE	Ethylene Glycol
		Water
	DCA	Ethylene Glycol
		Water
CUMMINS	CHROMATE	Ethylene Glycol
		Dowtherm 209
		Water
	BORATE	Ethylene Glycol
	DCA	Ethylene Glycol
		Water
DETROIT DIESEL	CHROMATE	Water
	BORATE	Ethylene Glycol
		Water
		Ethylene Glycol