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AMTRAK  
SPECIFICATION #CRM-79-4  
MARCH 1, 1980  
CONVERSION OF CONVENTIONAL  
TYPE CARS  
TO RUN WITH AMTRAK  
HEAD END POWER TRAIN CONSISTS

Approved by

Date

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MCHSP.110

Revision E 6/12/89  
Revision D 10/04/87  
Revision C 3/25/87  
Revision B  
October 8, 1982

## Record of Revisions

Rev	Date	Page	Change
C	3/25/87	9, 9 1/2	Clarified conduits req'd for 480 control, MU and 27 Pt. Comm. Trainline
D	10/4/87	15 16 17 17	Revised drawing list Added specification List Test G.2.2 was G.8 Added test G.2.6 B
E	6/12/89	14 13	FDB was FB; EHD was EHB Revised paragraph c to clarify.

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PRIVATE CAR SPECIFICATION

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## PRIVATE CAR SPEC

### 1.0 SCOPE

This document describes Amtrak's minimum requirements for the handling of privately owned cars in Amtrak head end power trains.

The cars are to be capable of being used anywhere in an Amtrak consist without restriction, including full 480V, 1600 Amp, rated trainline for HEP service and a pass-through 27 point communication cable.

\*B This spec is to be used as a supplement to Mechanical Instruction SMP 28603, Latest Revision "Inspection of Private Owned Cars," and SMP # 25603, "Speed Restriction Policy for Private Cars."

### 2.0 GENERAL

As used in this specification, these terms shall be understood to mean as follows:

- a. The Owner is the owner of the private car.
- b. The Builder is the authorized builder and executer of the conversion of the car.
- c. Prime Contractor

The car owner shall be designated as the Prime Contractor. The Prime Contractor shall assume the responsibility for the converted car preparation, operational tests, and inspections.



### 3.0 RESPONSIBILITIES OF OWNER

#### a. Compliance with Applicable Regulations

The Converted Cars, shall comply in all respects with the Applicable Standards and Recommended Practices adopted by the Associated of American Railroads (AAR); laws, rules and regulations stipulated by the states in which Amtrak trains operate;

ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers Inc.
AREA	American Railway Engineering Association
FDA	Food and Drug Administration of United States Department of Health, Education and Welfare
IES	Illuminating Engineering Society
USPHS	United States Public Health Service of the United States Department of Health, Education and Welfare
ASA	American Standards Association
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
NFPA	National Fire Protection Association
NTSB	National Transportation Safety Board
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
IEEE	Institute of Electrical and Electronic Engineers
SAE	Society of Automotive Engineers
DOT	U.S. Department of Transportation
FRA	Federal Railroad Administration of US DOT
NRPC	National Railroad Passenger Corporation

#### b. Conformity with Specification

Those items in this Specification which differ from the Builder's standard shall be per the Specification unless the Builder obtains Amtrak written approval for change. "Approved Equal" herein refers to those situations wherein the Builder, if he desires to offer substitute items, parts, materials, or equipment in lieu of those designated

in this Specification, shall obtain Amtrak approval in writing to make such substitutions. The burden of proof that the substitution is equal shall rest with the Builder. Such written approval does not in any way relieve the Builder of the responsibility for the proper function and adequacy of the installed equipment.

c. Drawings Required

The car owner shall maintain copies of the following drawings. Before initial car approval, these drawings must be submitted to Amtrak for review.

- a. 27 Point cable and receptacle application
- b. 480 volt cable and receptacle application
- c. Electrical schematic of any car systems which will be supplied from the HEP trainline system or the 27 point trainline.
- d. Piping schematics
- e. Electrical Load Charts for cars using HEP (Phase balance must be within 5% full load).
  1. Connected Load Winter
  2. Connected Load Summer
  3. Normal Load Winter
  4. Normal Load Summer
- f. Equipment arrangement drawing
- g. Car dimensional clearance drawing

#### 4.0 SERVICE COMPATABILITY

The intention of this spec is to ensure unrestricted use of the private car anywhere in any HEP Amtrak train. To fulfill this requirement the following systems must be compatible, and conform to corresponding Amtrak drawings:

##### a. Brakes

\*B The brake system shall conform to the requirements of Amtrak's Mechanical Instruction SMP 28603, Latest Revision "Inspection of Private Owned Cars" and 25603 "Speed Restriction Policy for Private Cars."

##### b. Main Reservoir Trainline

Add Vented  
locking  
cks

A main reservoir of 1" diameter, extra heavy steel pipe is to be provided. All hose connections shall be double wire braid reinforced (AAR M618) except brake pipe trainline hoses which shall be AAR branded hose (M601) less than 1 year old from date of manufacture. Main reservoir hose connections shall be in the same location as required by AAR for train communication signal hose.

##### c. Conductors Signal Line

Present signal air equipment, signal valves, piping and hose may be removed. If conductors signal trainline is maintained, it shall be labeled as such, as well as the main reservoir trainline.

d. The diaphragms and face plates are to be modified to Specification DM-77-22 to make them compatible to Amfleet and Conventional HEP cars. Superliner compatibility requires removal of the diaphragm.

e. 480 Volt HEP Trainline System

Four identical car mounted Pule National Co.'s or equal 480 volt receptacle shall be mounted on each car end in accordance with drawing SK-D-112779. Receptacles shall conform to Amtrak Specification D-77-24. All power receptacles and plugs shall be painted red and labeled "DANGER 480 VOLTS."

The power trainline wiring installed by the BUILDER shall be open wiring made up of four sets of cables. Each set consisting of three 4/0 cables, four wires per phase, for the 480 volt circuits and, in a separate conduit, ten conductors #10 wires for the power loop control circuit.

The cables shall run the full length of the car, terminating at the four power receptacles at each end of the car. Wiring is to comply to Figures 4-7 including truck area protection and cleating.

On each car, leads from the 480 volt power cables shall be routed to a common bus bar located in the main terminal box under the car. This box is to conform to Drawings B-00-1017, E-00-1018 and E-00-1019. If the car uses Amtrak supplied 480 volt power, this shall be taken from the trainlines at the MAIN JUNCTION BOX, conforming to drawing E-01-1306 and Figure 7.

f. 27 Point Trainline System

The car is to be equipped with 4-27 point receptacles, two per car end, one each on the left and right side. Application is to conform to drawing SK-D-112779. Receptacles are to be Pyle National Model WWRF-27-AMTR-L180, and are to be painted blue.

\*B

No dummy receptacles are required  
No loop relay panel is required

The undercar cabling is to be run in a conduit, with a junction box located at each end of the car for the pigtail to carbody wire connections. Communication cable wire size, type and pin assignment shall comply with drawing #E-01-1306.

g. Receptacle Labels and Warnings

Appropriate warnings and identification of all trainline connections shall be prominently displayed on the outside end of the vestibule end sheet. Simplified instructions and directions for connection, disconnection and storage of jumpers shall also be stated, including safety precautions and sequence of operations.

Color coding as follows shall be used to assist personnel in the make-up of trains. Communications - Blue jumper, Blue receptacle; Power - Red Jumper, Red receptacle.

h. Jumper Cable Required

The Builder shall furnish four power jumper cables, Pyle National 51 inch or approved equal. Builder shall furnish one Pyle-National WWPCJ-2746-AMTR communication, 60 inch long jumper cable, or Amtrak approved equal, with each car.

i. Jumper Cable System

Electrical trainline connections for three phase power as well as inter-car communications and control circuits shall be made between cars by jumper cables. Connections between the converted cars and between adjacent passengers cars shall meet normal train operating conditions of horizontal curve negotiation, normal track profile and geometry, without pinching, cutting, or stretching of cables.

Minimum radius of horizontal track curve with cars coupled.

250'-0"

Cars must successfully negotiate a 250' radius curve without easement to tangent track.

Extreme Crossover condition to be negotiated by coupled cars - #6½ on 12'-0" track centers.

j. Battery Trainline

If existing, to be in working order. If none exists, no new application is required.

k. Marker Lights

Two red, sealed beam, lamps, mounted in stainless steel enclosures, are to be applied to each end of car to serve as marker lights. (Luminator #0103086001 or equal with red lamp G.E. 60 PAR/2/R). Lamp and fixture must be FRA approved in compliance with Amtrak Spec D-77-27. The marker light resistors, one per lamp adjusted to make the lamp comply to the FRA approval. A single center off switch, permanently labeled is to be provided in the electric or switch locker to control the marker lights at each end of the car. Car wiring is to comply with Spec. D-77-27.

5.0 ELECTRICAL

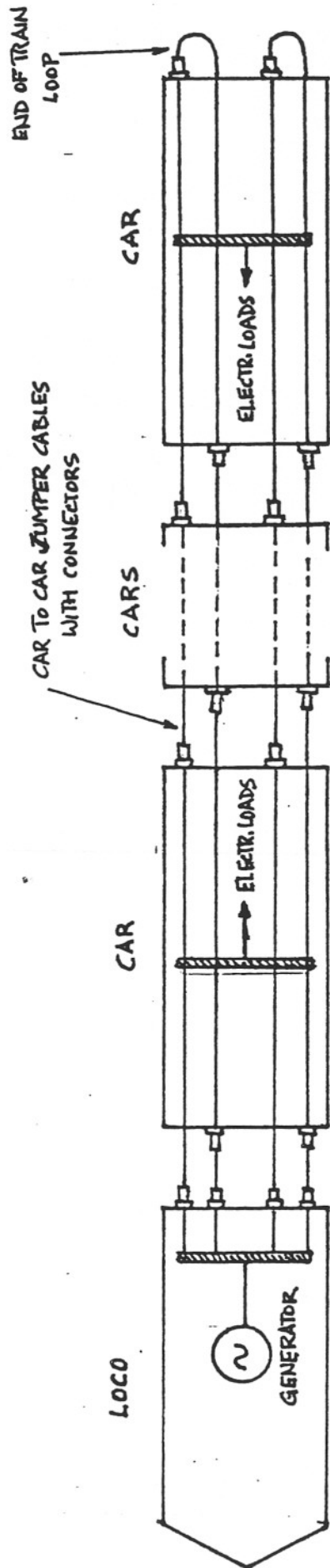
a. General Wiring

All new conductors shall be Exane (or equivalent), integrally insulated and jacketed, and shall have the properties and characteristics as specified in Amtrak Specification Q-78-7, except those conductors used for resistors or heater leads, which shall be in accordance with A.A.R. Specification #590.

b. 480 Trainlines

The main power wiring must be run with all (3) three phases grouped together at all times; if they are separated they must be run thru non magnetic materials to prevent

# 480V POWER TRAINLINE SYSTEM





\*B local induction heating. Cable cleats shall conform to figure 4A.

Power trainline cables shall be supported by neoprene cable cleats throughout the underfloor with sufficient spacing between individual conductors to permit adequate ventilation.

In the truck areas, these cables shall be protected by running through 3" rigid galvanized steel conduit. All conduit bushings shall be the insulating type.

Phase rotation is A, B, C with pin #1 (black) Phase A, pin 2 (white) Phase B and pin #3 (red) Phase C.

Lugs used to terminate the 480 volt cables and the receptacle pigtails shall be AMP 326803 and shall be hydraulically crimped with appropriate tools, as recommended by the lug manufacturer. See Figure 6.

\*B

c. 480 Control Wiring

This wiring shall comply with Drawing #E-01-1306. It

\*C

shall be run in a separate rigid galvanized steel conduit. *Only the 480 volt control wires can occupy this conduit.*

Connections will be only with double-crimpled ring-tongue terminals as the drawings specifics. Each connection will be pulled tested to check for proper crimping. These are vital circuits. Also see Figure 6.

\*B

\*C

d. 27 Point Trainlines

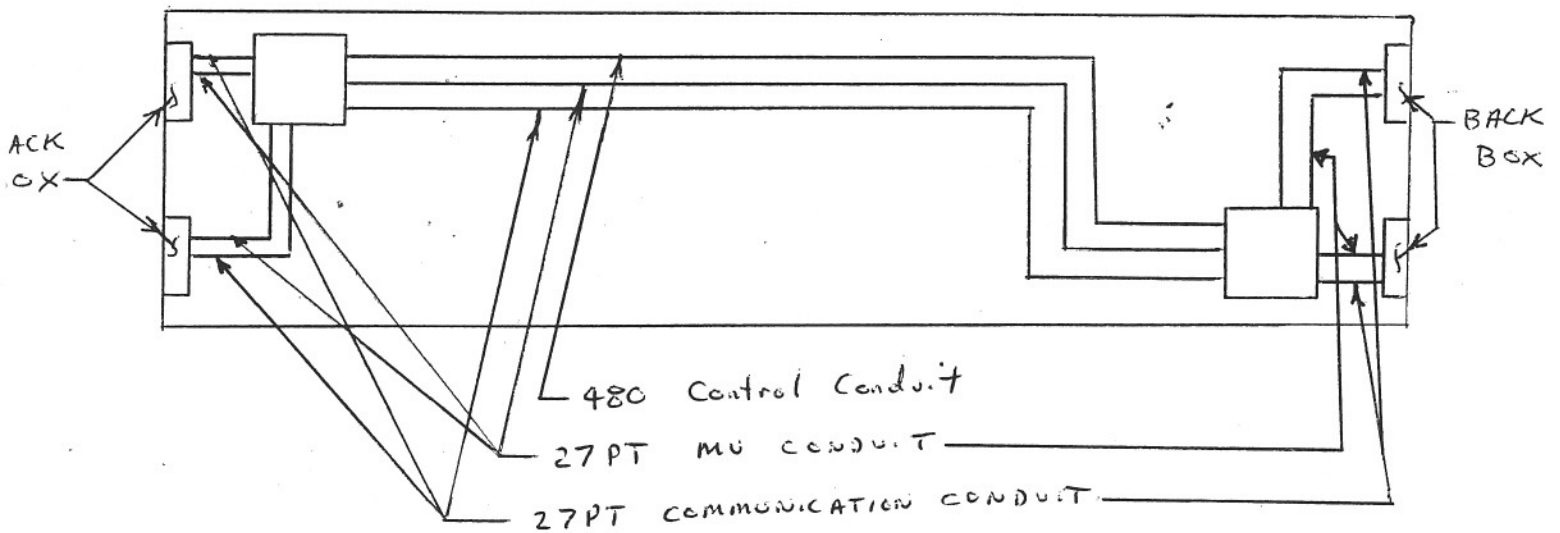
The rear of these receptacles shall be enclosed in a water-tight stainless steel box. (Back of receptacles is not intended for exposure to weather.)

### 27 Point Communication Trainline

This wiring shall comply to Drawing #E-01-1306. It shall be run in its own rigid galvanized steel conduit. Only the 27 Point communication wires can occupy this conduit. Connections will be only with double crimped ring tongue terminals as the drawing specifies.

### 27 Point M U Trainline

This wiring shall comply to Drawing C-01-7169. It shall be run in its own rigid galvanized steel conduit. Only the 27 Point M U wires can occupy this conduit. Connections will be only with double crimped ring tongue terminals as the drawing specifies.



TRAIN LINE CONDUITS

e. Fitting and Junction Boxes

The fittings, outlet boxes for car wiring shall be as manufactured by the Thomas and Betts Company, Appleton, Crouse-Hinds, Pyle National, or approved equal. All covers for undercar fittings, etc., shall be gasketed using approved materials. Interiors of junction boxes shall be suitably protected by insulating paint against condensation and corrosion. When more than one supplier is used, all fittings which require covers and are of the same size shall be supplied by the same MANUFACTURER.

f. Application and Installation of Wire

All wiring shall be performed by or under the direction of an experienced wireman. The wireman shall be provided with appropriate tools for skinning insulation, cutting, tinning, soldering and attaching mechanical or compression-type terminals to the conductors.

Care must be taken in removing insulation from the conductor to avoid nicking of the wire or strands of the conductor cable.

Car wiring methods and materials shall be in accordance with Chapter 3 of the National Fire Protection Association's Publication N.F.P.A. No. 70 (N.E.S.C.) current issue.

g. Splicing - Taping

Splicing of any 480 volt, 480 control trainline, 27 point trainline conductors shall be avoided. Splicing or conductors in conduit will not be permitted. Where it is unavoidable, splices shall be made in junction boxes and the spliced joint shall be as mechanically strong and shall have the same conductivity as any other part of the conductor, without the use of the solder. Approved solderless connectors shall be used for splicing. The joint shall be insulated with tape so as to be at least equivalent to the insulation of the conductor. The outside diameter of the spliced portion of the cable after the tape insulation is applied shall not exceed the outside diameter of the unspliced portion by more than 40%.

h. Tape

An approved polyvinyl chloride electrical tape with Buna "S" type adhesive, 0.007" or 0.010" overall thickness, or approved equal, shall be applied. The above materials shall be suitable for use with the conductor insulation without discoloring or corroding the copper wire and shall provide 600 volt insulation.

i. Terminals

Terminals shall be the pre-insulated ring-tongue double crimp type.

Crimp terminals shall be used on all new wiring.

Conductors which will be subject to motion relative to the terminal shall be protected by suitable means to minimize breakage of the conductor at or near the terminal. In general, connections shall be made by means of terminal blocks. Faston or set screw type of connections shall not be used. Solder connections may be used as approved by Amtrak.

j. Marking

All wires and terminals studs as called out on Amtrak drawing shall be plainly and suitably marked, so that circuits may be easily identified. Markings shall be non-conductive.

k. Electrical Grounding

Flexible braided shunts shall be provided between the carbody and truck bolsters, between the truck bolsters and the truck frames, and between the truck frames and the journal bearings.

6.0 CARS USING 480 HEP POWER

Due to the vital nature of the 480 volt trainline system, great care must be taken on any car using HEP to minimize the possibility of 480 volt grounds. All HEP power sources are ground fault protected and will shut down if even a minor fault occurs.

a. Undercar Conduit

All equipment which uses 480 volt power from the HEP trainline system shall have its undercar wiring run in rigid galvanized steel conduit. Exane (or approved equal)

- jacketed wire of adequate physical strength may be cleated in place using cleats made of approved synthetic material, at frequent intervals without conduit or raceways, provided strain relief bushings are used at locations leaving and entering conduit, wire raceways or equipment enclosures.

b. Interior Wiring

All HEP fed 480 volt equipment shall be wired with Exane or approved equal. Wiring in interior areas shall be run in either thin wall steel or aluminum conduits, metal ducts, or other raceways designed in an approved manner for the application of electrical wiring. Great care must be taken to minimize the possibility of a ground on any 480 volt wiring or equipment. Should floor heaters be operated on 480 volts, they must be double insulated. BX cable shall not be used.

c. Segregation of Voltages

\*E Wiring of different voltage levels will be segregated as follows:

480 VAC

240 VAC

120 and 120/208 VAC

DC

(Also refer to trainline segregation, section 5.0, part c and d.)

Segregation will include use of separate conduits both undercar and within the car. Wiring of different voltage groups may pass through the same enclosures, such as pull boxes, junction boxes, terminal boxes, etc., however, wire operating at different voltages shall not be banded together.

\*E

It is recognized that in some areas, such as light fixtures having a main and an emergency lamp, DC and 120 VAC wiring must be run together. However, bundling in this way must be kept to a minimum.

- d. The 480 trainline tap from the main junction box to the 480 main breaker is to be run in a separate conduit from the junction box to as near the main breaker as possible. This wire shall be very carefully protected against any mechanical injury. This wiring is to conform to Drawing E-01-1306 and Figure 7.

\*B

e. 480 Volt Main Circuit Breaker

The 480 volt main circuit breaker shall be Westinghouse 3 phase ~~FDB~~-frame or ~~EHD~~ circuit breaker, such as ~~FDB~~-3150. Do not substitute. Provision is to be made to lock open this breaker with a padlock.

\*E

f. 480 Volt Breakers

All other 480 volt circuit breakers are to be Westinghouse type ~~EHD~~.

\*E

(It is recommended 240, 120 VAC breakers be Westinghouse QC-H series).

g. Electric Locker

The Electric locker is to be lined with a fire proof material such as CEM-FIL #125S. The floor to have a rubber mat for safety.

All of the 480 and any new 240 and 120 VAC circuit breakers and equipment to be provided with a dead front panel and to be completely enclosed. The contactors and relays are to be visible for mode of operation and protected against accidental contact by application of a transparent cover. The panel is to be clearly marked in 2" high letters.

(RED)

h. The Electric locker (2) lights are to be battery operated.

i. Labels

All new circuit breakers, contactors, pushbuttons, relays are to be clearly identified with permanent type labels.

7.0 CAR WEIGHT

The Car Builder shall weigh on approved scales each end of the car with trucks prior to shipment. Scale weight tickets shall be furnished to an Amtrak Inspector.

8.0 AMTRAK DRAWINGS FURNISHED

\*D

RFB 102986	"LISTENING IN"
{ FIG 3	HEP TRAINLINE CONNECTOR
{ C-OS-7171	LOCATIONS
	END OF CAR TRAINLINE
	CONNECTOR LOCATIONS
E-00-1809	FIXED 480V JUMPER CABLE
	MODIFICATION
E-01-1306	480V § 27 POINT COMMUNICATION
	TRAINLINE SCHEMATIC
C-01-7169	MU TRAINLINE SCHEMATIC
C-01-1498	27 POINT COMMUNICATION JUMPER
	CABLE ASSEMBLY
E-00-556	TL COMMUNICATION JUNCTION BOX
	ASSY & INSTALLATION
B-00-1017	BUS BAR - 480V JUNCTION BOX
E-00-1018	480V JUNCTION BOX ASSEMBLY
E-00-1019	480V JUNCTION BOX ARRANGEMENT
D-279	PULL BOX
D-OS-1355	CLEARANCE DIAGRAM



## SPECIFICATIONS

D-77-27	Marker Light Specification, Marker Light Wiring
Q-78-7	Wire Spec
D-77-24	480 Jumper Cable

### \*B ILLUSTRATIONS:

Typical Transformer Installation  
Diaphragm Modifications  
HEP Trainline Connector Locations  
HEP Car J-Box and Cable Arrangement  
Cable Cleat  
Typical Installation of 480 Pigtail Splices  
480V Power and Control Wire Connections  
480V Trainline Tap  
Approved Marker Light Fixtures  
Conductor Signal Button  
Ground Strap Installation

### 9.0 CLEARANCE

The Builder shall submit car dimensions to Amtrak's Chief Mechanical Officer in accordance with Standard Maintenance

\*B Procedure (SMP) #28603.

### 10.0 TESTS AND ADJUSTMENTS

Tests shall include the following (as a minimum). All tests data to be recorded and furnished to Amtrak. Megger, hipot and continuity of 480 power, 480 control and 27 point cable must be witnessed by Amtrak. See Test Spec.

PQ-79-1 Rev. A.

- 1.1 Car Clearance
- 1.2 Car Curving and Truck Clearance
- 2.3 480 Volt Trainline
- 2.4 27 Point Trainline - Part C or D
- 6.2 Megger/Hipot
- \*Q 6.2.2 480V Trainline Cable
- \*Q 6.2.6B PRIVATE CAR ELECTRICAL LOAD/PHASE BALANCE
- 10.2 Carbody Leveling

4

AMTRAK

PRIVATE CAR HEP CONVERSION

INSPECTION

JANUARY 22, 1981

b Updated 11-19-86  
c Updated 10-4-87

## Private Car HEP Conversion Inspection

This inspection procedure is to be used in conjunction with the mechanical inspection from standard maintenance procedure (SMP) manual #28603.

### A. General

1. Check that all undercar equipment is safety-hung--that is, the component bracket rests on top of the carbody bracket, and that the bolts are in from the top. *Check bolt sizes are reasonable for the equipment supported.*
2. If any transformers are installed undercar, they must not be hung from their own brackets, but rather be supported from the bottom of a cradle or flat plate (See figure 1).
3. Check that the diaphragm is modified according to the Amtrak requirements, see figure 2, sheets 1-8.

### B. Electrical

1. Refer to figure 3. Check the dimensions of each of the 480 receptacles, either 2 or 4 on each end of the car. All receptacles must be within the dimensions shown on figure 3. Any deviations from this drawing must receive Equipment Engineering approval.

2. Refer to figure 3. Check the dimensions of each of the 2-27 point receptacles on each end of the car. If the car is to be used in rear end only service, only 2 receptacles are required on one end of the car.

\*B 3. Check 480V cable wire type. It must be ~~Exane, Exar,~~<sup>\*C</sup> or approved ~~equi~~. Other wire types must have Equipment Engineering Approval.

4. Each car must be equipped with a 480V J-box, according to the ~~dwgs~~. Each 480V receptacle must have 3 - 4/0 cables between it and the 480V J-box. See figure 4.

\*B 5. Check cleating of 480 cables. Must be cleated at least every 4 feet. Check for proper cleating material. Cleat must conform to figure 4A.

6. Check that no cleats pinch the wire--i.e., no cleats are overtightened.

7. Check dress of 480 cables--no interference with undercar equipment, no rubbing possible. See figure 5.

8. Check for clearance between undercar cables, J-boxes, etc., and the trucks and couplers. Swing couplers. If interference is suspected, car must be curve tested, per test 1.2.

9. Remove sleeve from one 480V receptacle-to-carbody wire splice. Check for proper construction of splice. See figure 6.
10. Check splice:
- a. 4/0 wire hydraulically crimped
  - b. Correct lug used - 2 hole lug
  - c. 2 3/8-16 x 1" Cadmium Plated bolts used to secure splice.
11. Uncover 480 control wire splice. It must be either: butt splice or splice on a terminal block using ring tongue lugs (Not spade lugs). The lug must be the double crimp type--2 crimps on each wire; one on the conductors, one on the insulation. Check quality of crimp. Crimp must have been made with a ratchet-type lugger, ~~NOT~~ *PLIERS TYPE*.
12. Inspect 480 - J-box
- a. Must be stainless steel
  - b. Must be non-magnetic stainless
  - c. Strain relief bushings for all 24 wires (*fewer if partial system*)

13. Remove cover from 480 J-box. Inspect
- a. Cover for proper fit and seal
  - b. Proper bus bar installation on insulators
  - c. All 24 cable crimps to be hydraulic
  - d. Correct lug used
  - e. All bolts to be tight

\*B

14. Inspect 27 point J Boxes

- a. Must be stainless steel
- b. All wires to be attached with ring-tongue lugs for terminal blocks. *pull test several for crimp quality*
- c. All lugs to be double crimped (as item 11) and made with ratchet crimper.
- d. If 480 control wires use same box, they must be segregated from the other 27 conductors.
- e. All <sup>terminals</sup> ~~screws~~ must be tight and all wires labeled.
- f. Check wire gauge -
  - wire #2 is #10 AWG
  - wires 11-23, 26, 27 #12 AWG
  - wires 3-10, 24, 25 #14/2 Shielded

✓  
15. If car used 480V power, check main 480V breaker.

a. It must be Westinghouse FB or EHB breaker, no substitute.

b. Check wires between 480 J-box and main breaker.

\*B Must be EXANE or EXAR, and 1/0 minimum size. See figure 7.  
*or approved equal*

\*B c. All 480V wiring on each car to be EXANE or EXAR or *Approved equal* including interior car wiring. Check at locker.

16. Check that car is equipped with a marker light high on the end of the car in an unobstructed site. Marker light *may be portable*

17. Check that the light is one of those approved by the FR~~A~~  
See figure 8.

18. Check that the car is equipped with 2 conductor signal pushbuttons, one per end. Refer to figure 9. The circuit must correspond to drawing E-01-1306 including diodes.

### C. Brakes

1. Check the main reservoir line for the correct gladhand, and that it faces the correct way. (Couple to another car).



2. Check the main reservoir line is either type K copper tubing (brazed, not soldered joints) or extra heavy steel pipe.
3. Check ends of the main reservoir T/L for correct locking cutout cocks. The cutout cocks must *vent* the main reservoir hose when closed.
4. Check entire length of MR line. No connections to anything are permitted. If MR line was converted from signal line, the branches to the signal valves must be plugged at the MR tee. A valve is not acceptable.
5. Check entire length of brake pipe. Entire pipe, including branches, must be either extra heavy iron pipe, or type K copper tubing with brazed, not soldered joints.
6. If brakes have been modified, such as conversion to composition shoes, ascertain that the individual responsible understands correct techniques.

D. Trucks

1. Check trucks for
  - a. Welding in stress areas.
  - b. Loose components.
  - c. Interferences with car equipment.

- d. Springs--broken or going solid contact marks.
  - e. If nested springs are used, that adjacent springs are coiled in opposite direction.
  - f. Proper clearance within truck, such as sufficient clearance between bolster and frame.
  - g. Truck shimming is done correctly--all springs must sit at least 3/8" engaged into spring socket.
  - h. Equalizer seats and equalizer to frame clearance.
  - i. Full engagement of the centerplate.
  - j. Correct side bearing adjustment.
2. If car uses a Spicer Drive, check
- a. Worn bushings in torque and safety arm. Safety arm must show no signs of contact with truck transom. Put crowbar between safety arm and transom and try to move up and down. There must be NO slack at all in the bushings.
  - . Minimum clearance between safety arm and transom must be  $\frac{1}{2}$ ".
  - b. Remove drive shaft and inspect.
  - c. Measure length of drive shaft when solid. Measure length of gap on car between clutch and flange on spicer. Gap must be 3/4-1 $\frac{1}{2}$ " longer than driveshaft.
  - d. Car must have substantial safety hanger for driveshaft.

3. If car uses HEP and it is used to drive the genemotor, genemotor may not be connected to spicer drive. This is to prevent rotation of genemotor in one direction while spicer rotates opposite direction which will overspeed and destroy either clutch, driveshaft, genemotor, etc.

4. Ground Straps

- a. Check ground straps between truck and carbody.
- b. Check ground straps between truck and journal housing.

See figure 10.

E. Tests

The following tests shall be done; PQ-79-1 test #

- 1.1 Undercar Clearance
- 1.2 Curving & Truck Clearance
- 2.3 Trainline - 480 V
- 2.4 Trainline - 27 Point Communication
- 6.2 Megger / Hi-Pot
- 6.2.2 480 Volt Carbody Trainline Cable Test
- 6.2.6B Private Car Electrical Load / Phase Balance
- 10.2 Leveling of Carbody

\*B

F. Drawing of car electrical system powered on 480 or 480 derived HEP power. Phase balance must be within 5%. Drawings to be approved by Equipment Engineering.

If questions arise concerning interpretation of spec.,  
CONTACT SUPERINTENDENT, CAR MAINTENANCE, WHO WILL  
IN TURN CONTACT EQUIPMENT ENGINEERING, AS REQUIRED,  
MCHSP.110/dsy

Private Car HEP Conversion  
Inspection Check List

Car # \_\_\_\_\_ Car Name \_\_\_\_\_

\*B To be signed off and returned to Ed Laird, Mechanical  
Department, Washington, DC.

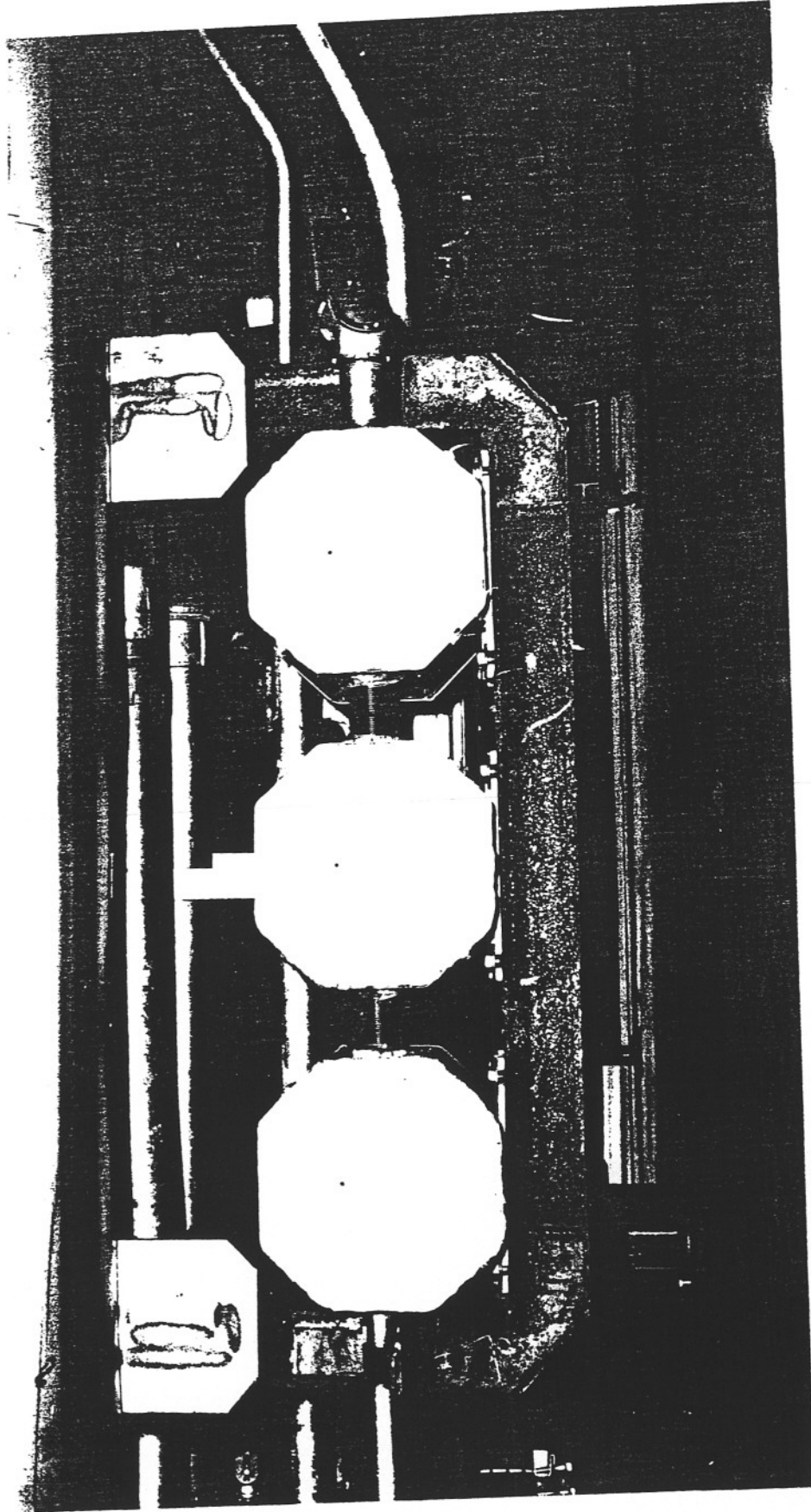
			OK	Reject
A.	1	Safety Hung Equipment	_____	_____
	2	Transformer Support	_____	_____
	3	Diaphragm Mods.	_____	_____
B.	1	Receptacle Location 480	_____	_____
	2	Receptacle Location 27 Pt.	_____	_____
	3	Wire type, 480 cables	_____	_____
	4	480 J-box and 4/0 cables	_____	_____
	5&6	Cleating	_____	_____
	7&8	Cable dress & interference	_____	_____
	9&10	480 splice inspection	_____	_____
	11	480 control wire splice	_____	_____
	12&13	480 J-box	_____	_____
	14	27 Pt. J-box	_____	_____
	15	Main 480 Breaker	_____	_____
	16	Marker Light Site	_____	_____
	17	Marker Light Approved	_____	_____
	18	Conductor's Signal Pushbuttons	_____	_____
C.	1	Main Reservoir Gladhands.	_____	_____
	2,3,4	Main Reservoir Pipe & Cutout Cocks	_____	_____
	5	Brake Pipe	_____	_____
	6	Brake Modifications	_____	_____
D.	1	Truck Inspection General	_____	_____
	2	Spicer Drive	_____	_____
	3	HEP/Spicer Drive	_____	_____
	4	Truck Ground Straps	_____	_____
E.	Test PQ-79-1:			
		1.1	_____	_____
		1.2	_____	_____
		2.3	_____	_____
		2.4	_____	_____
		6.2	_____	_____
*B		6.2.2	_____	_____
*C		6.2.6B	_____	_____
		10.2	_____	_____
F.	Electrical Drawings		_____	_____

Inspected By \_\_\_\_\_

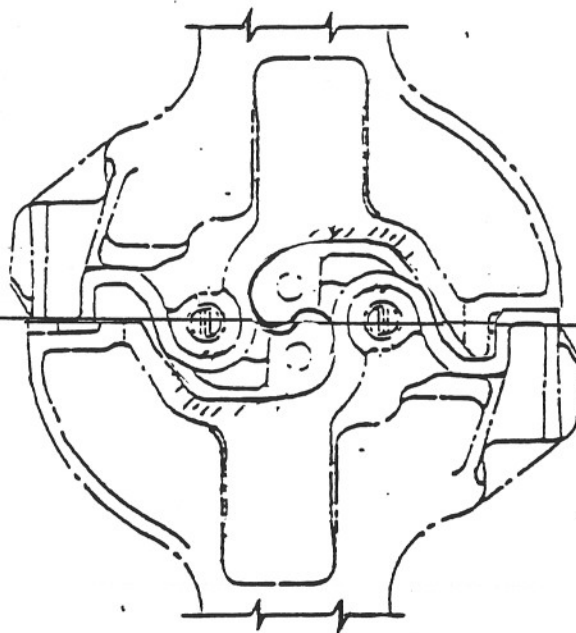
Date \_\_\_\_\_

INSTALLATION

TRANSFORMER  
40/110



COUPLER  
PULLING  
FACE

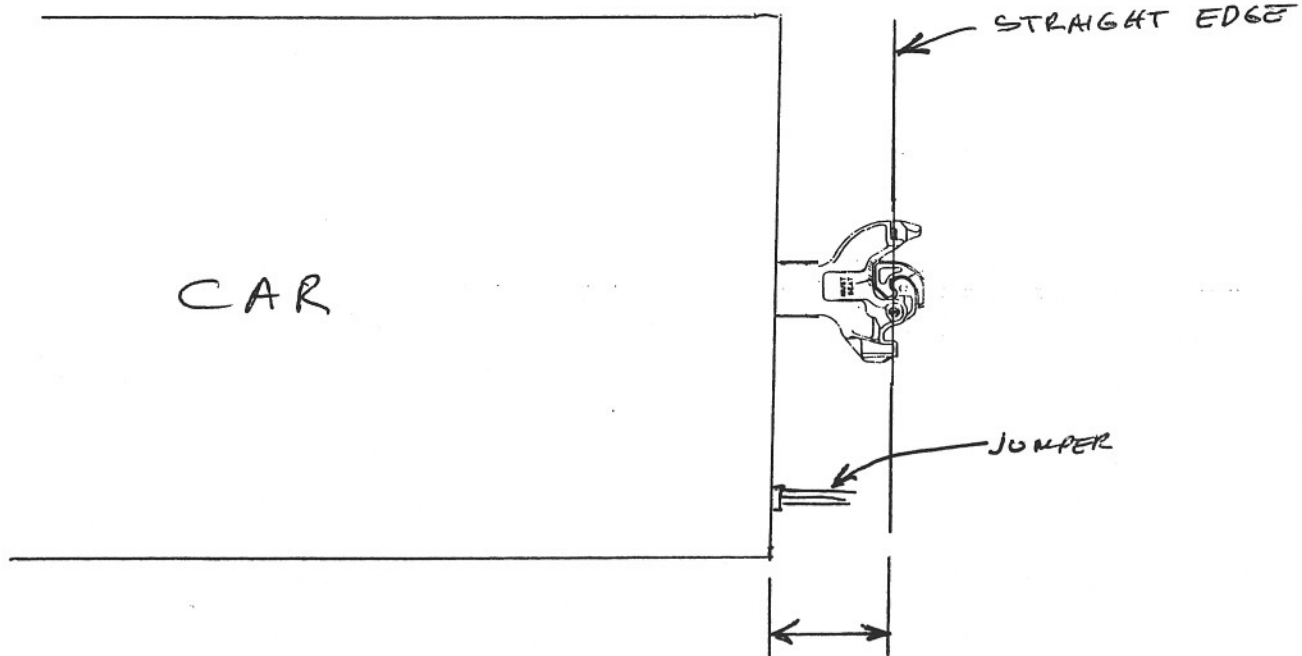


CAR

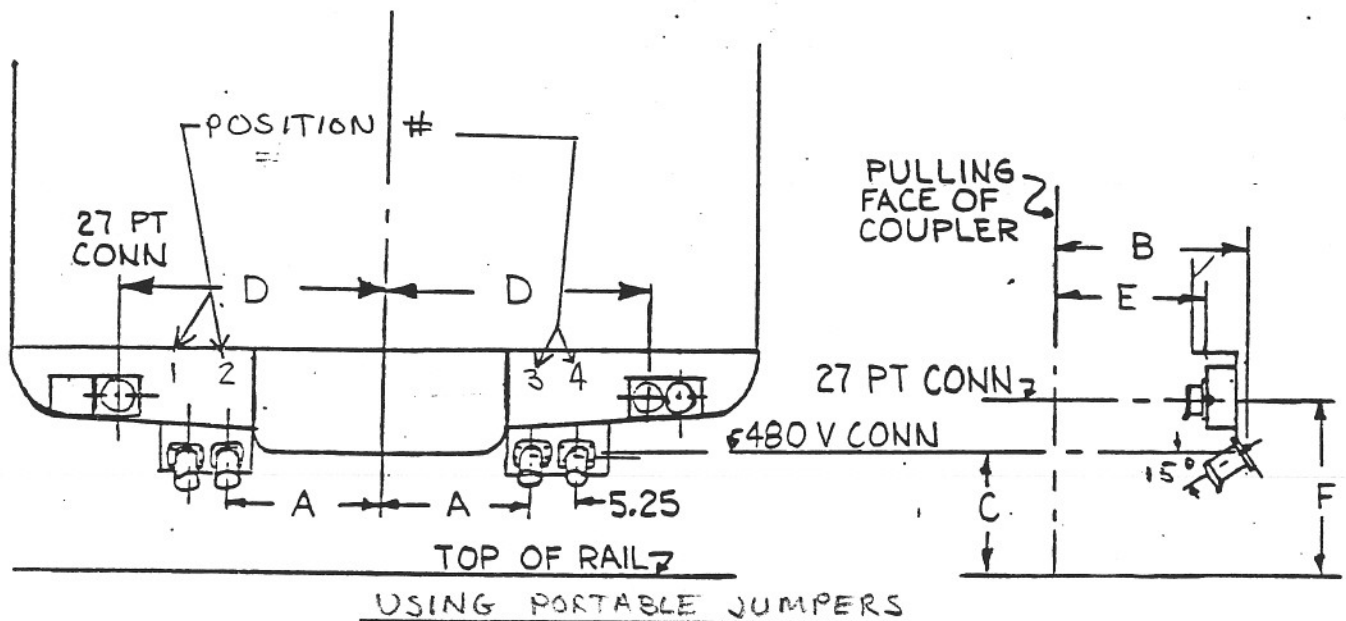
STRAIGHT EDGE

JUMPER

DIMENSION  
"TO PULLING  
FACE OF  
COUPLER"



# H.E.P. TRAINLINE CONNECTOR LOCATIONS



51" 480V JUMPER CABLES

60" 27 PT COMMUN. JUMPER CABLE

A	B	C	D	E	F
$20.25 \pm 2$ $-0$	$20.50 \pm 2$	$27.00 \pm 3$ $-0$	$38.25 \pm 2$ $-0$	$18.75 \pm 1$	$39.25 \pm 1$

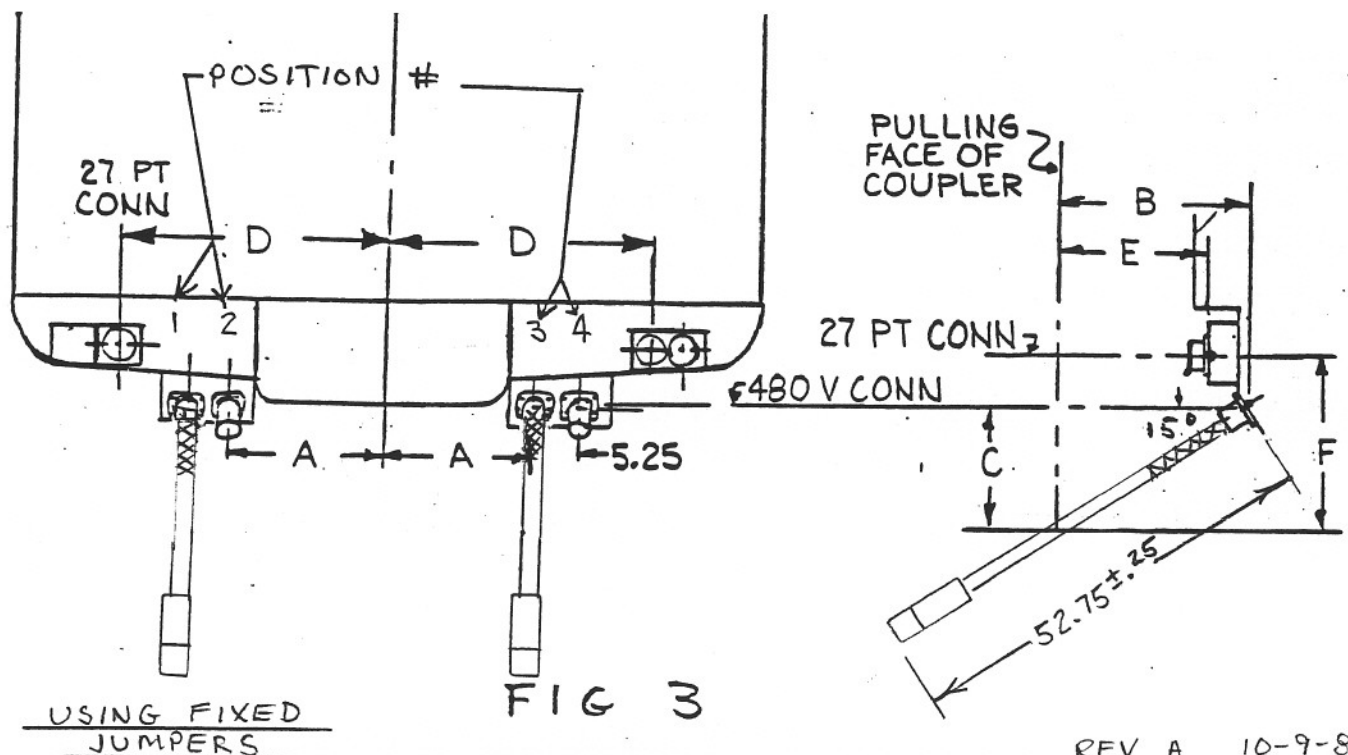
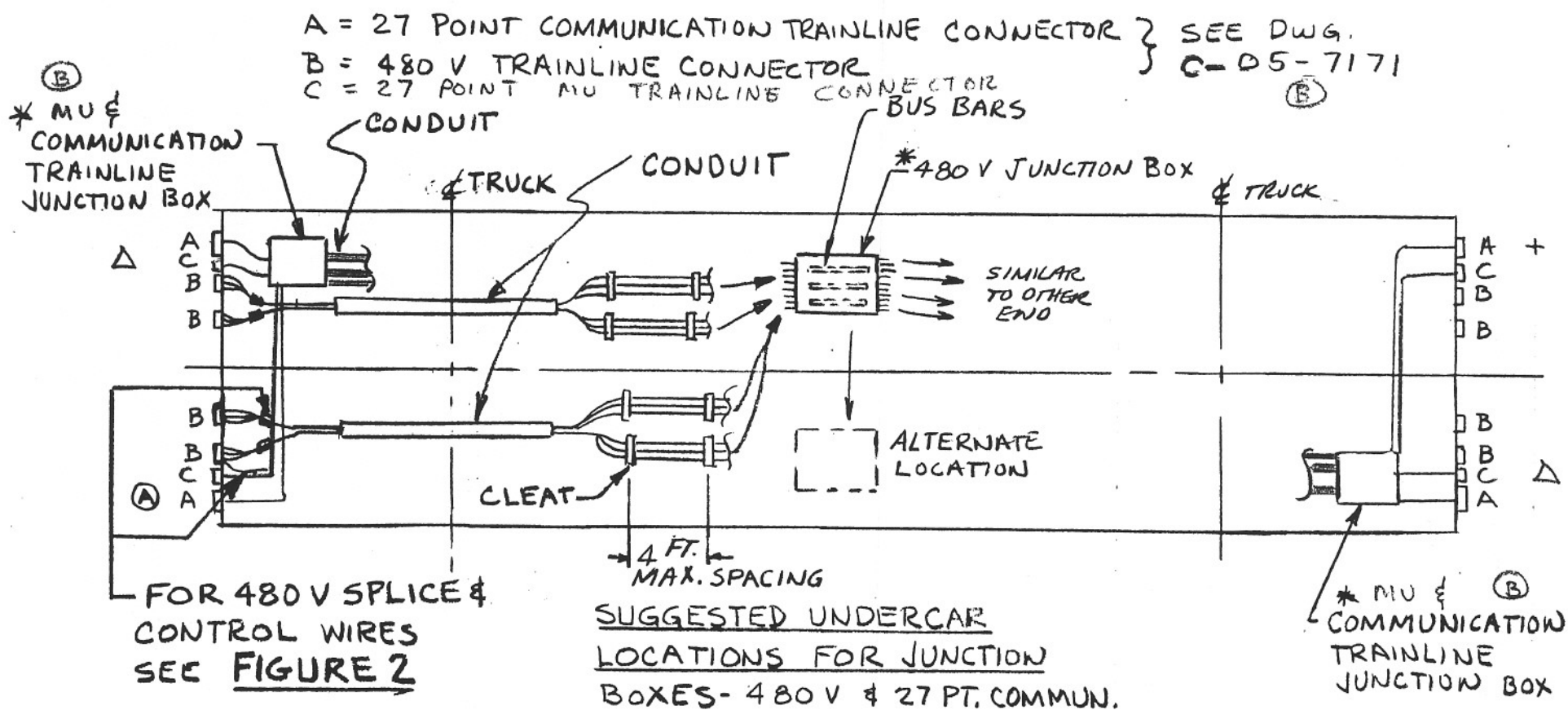


FIG 3



\* APPROXIMATE LOCATIONS FOR JUNCTION BOXES (PREFERRED)  
 SPACE REQUIREMENTS MAY DICTATE FINAL LOCATION OTHERWISE  
 Δ MU SYSTEM OPTIONAL

FIGURE 4

(B) REV B 10-87

H.E.P. CAR  
JUNCTION BOX AND  
CABLE ARRANGEMENT

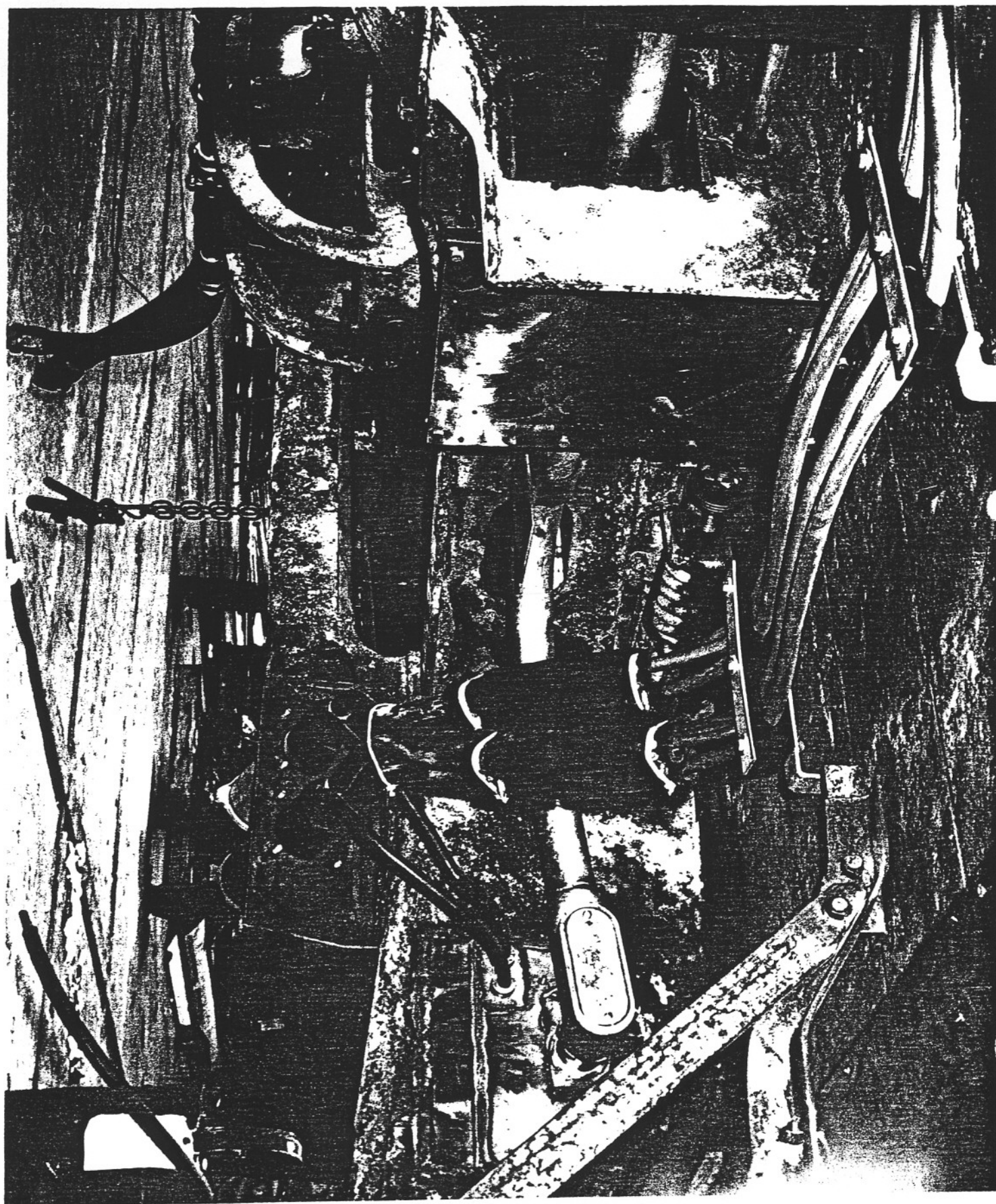
(A) REV A 10-87

SCALE: 1/4" = 1'-0"

LOC 4



FIG 5  
480 V PIGTAIL SPLICES  
TYPICAL INSTALLATION OF



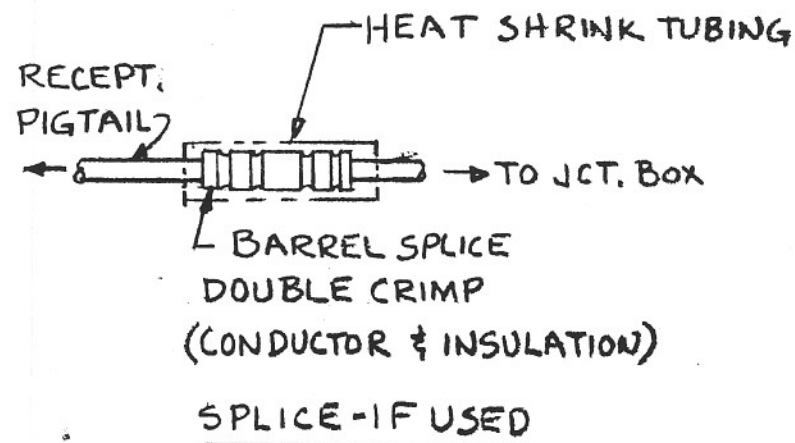
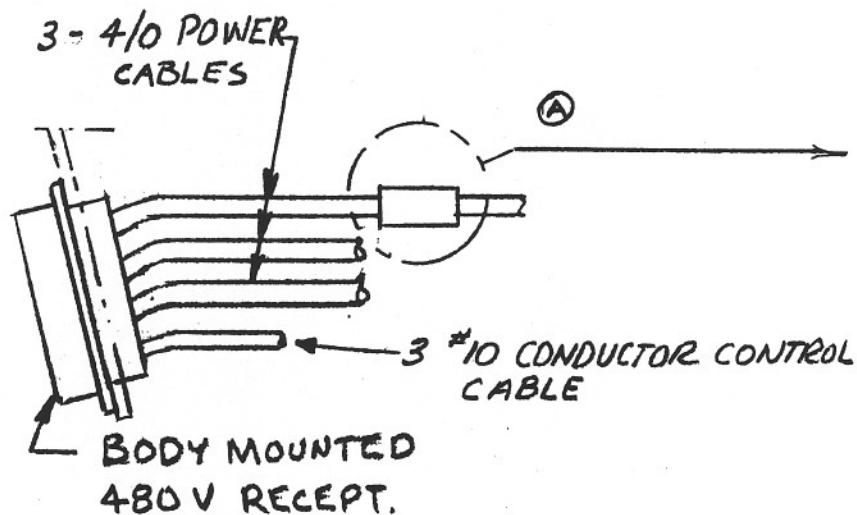
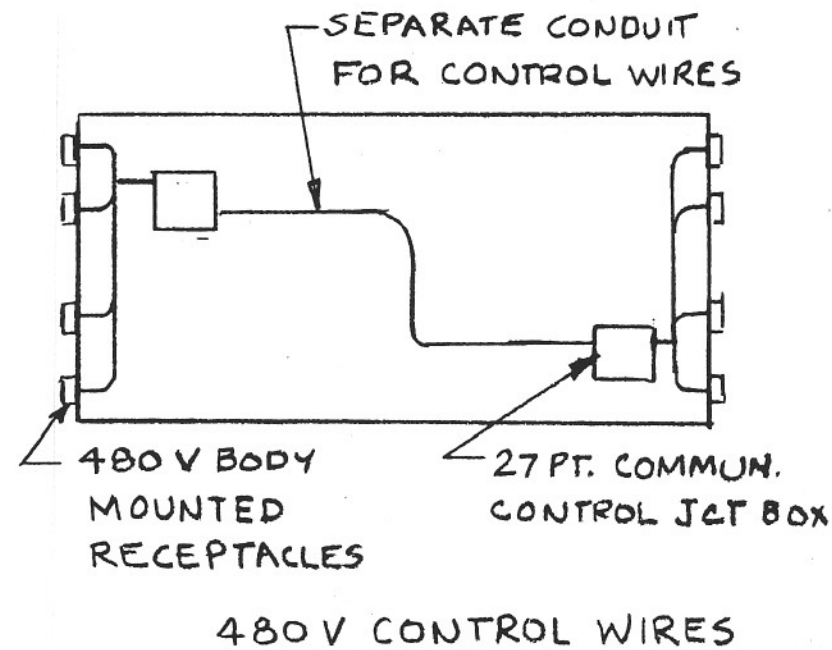
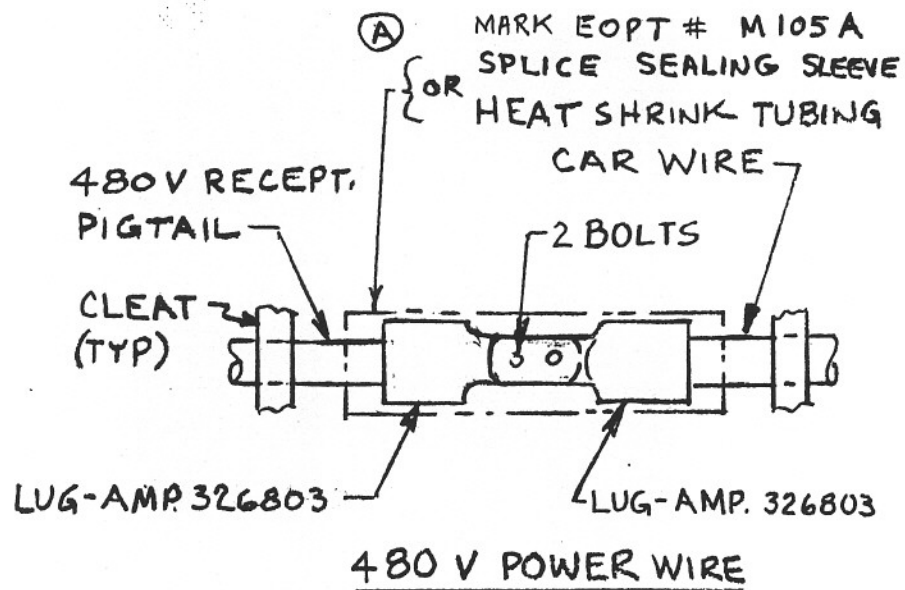


FIGURE 6

480V POWER AND CONTROL WIRE CONNECTION DETAILS

SCALE - NONE

(A) = REV - A 10-80

1284

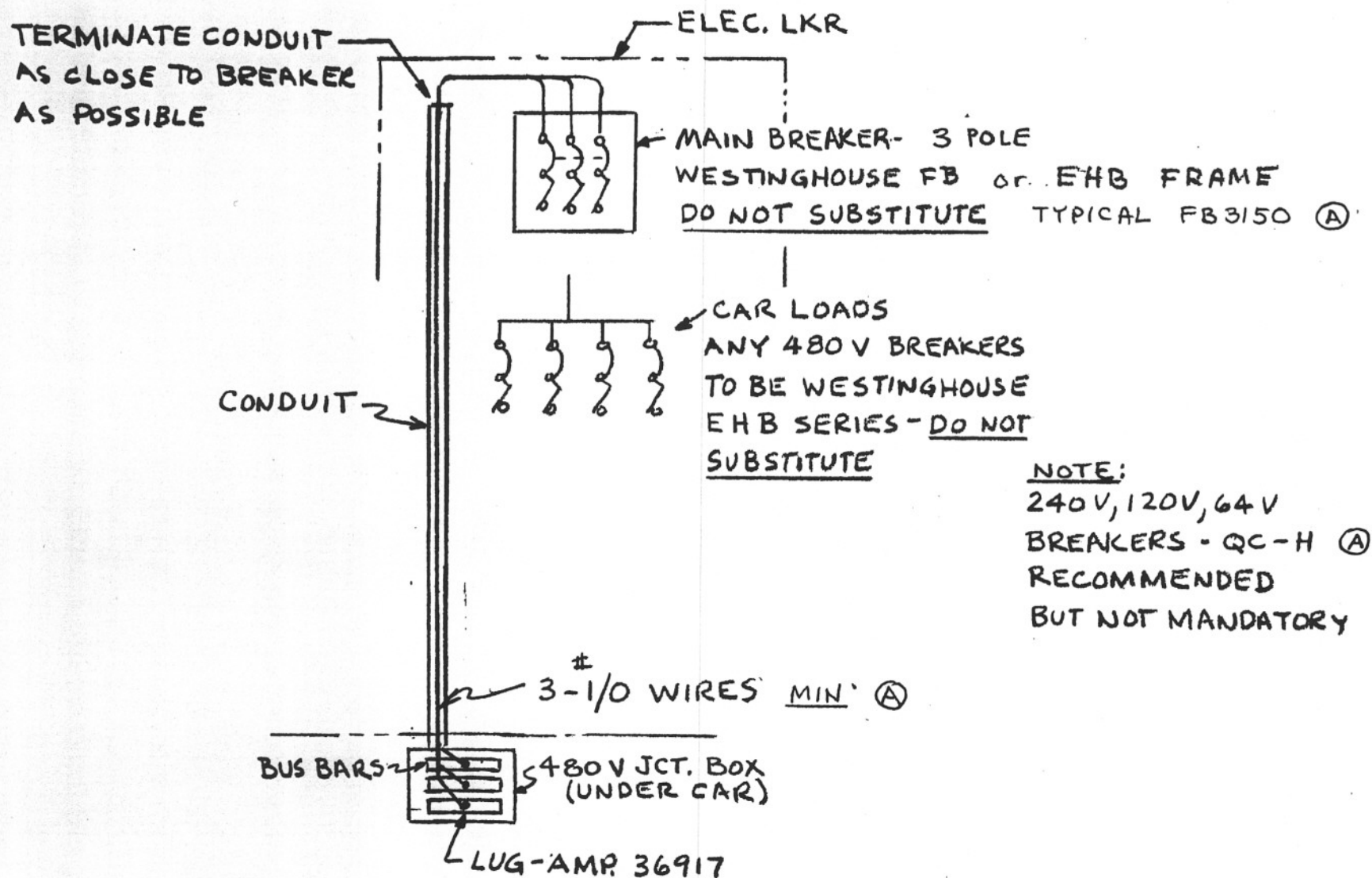
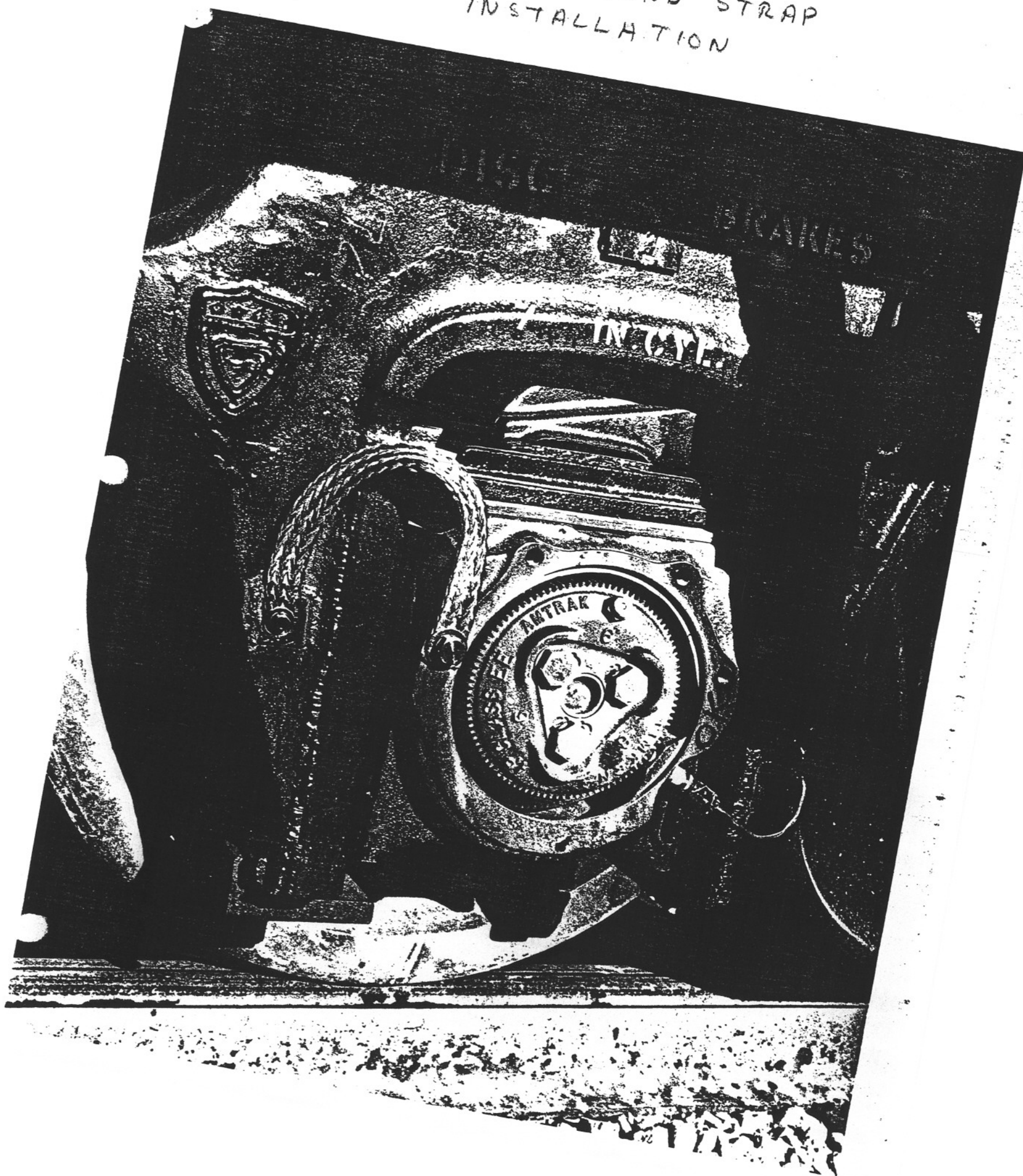


FIGURE 7

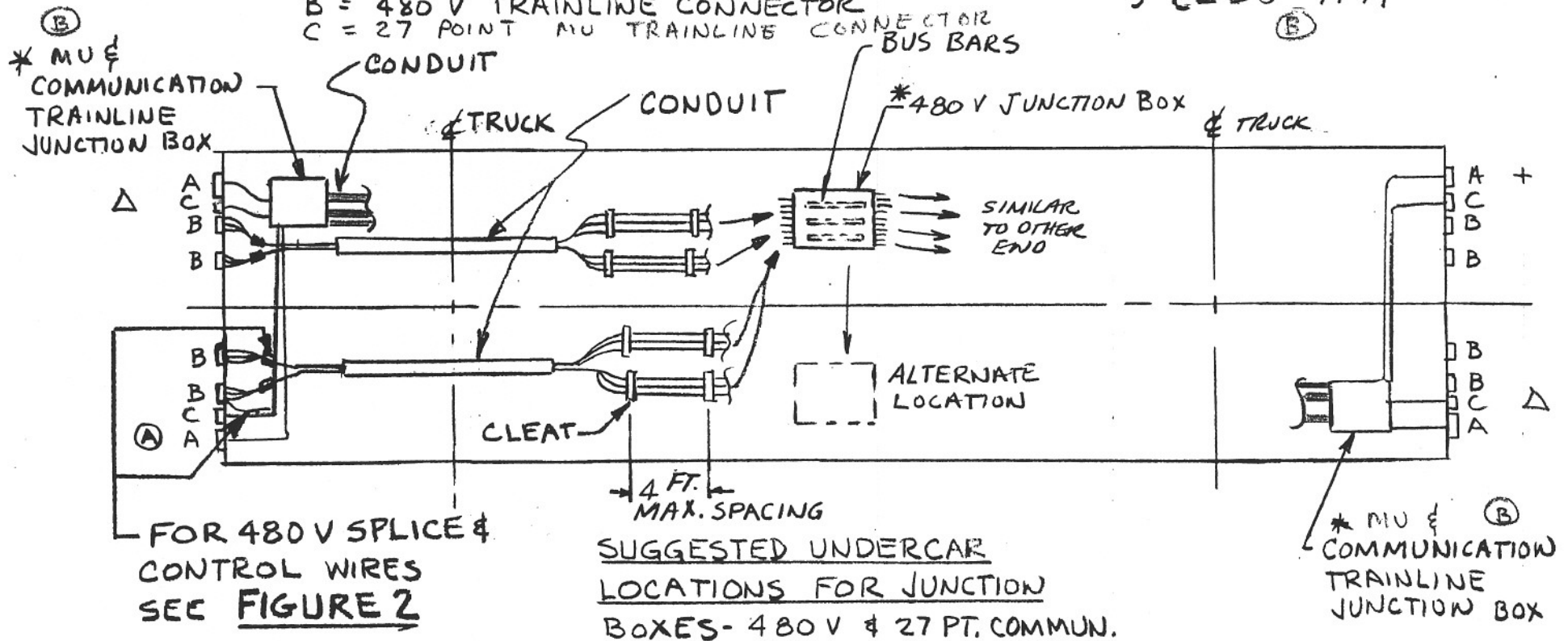
480 V TRAINLINE TAP  
TO PRIVATE CAR



FIG 10  
TYPICAL GROUND STRAP  
INSTALLATION



A = 27 POINT COMMUNICATION TRAINLINE CONNECTOR } SEE DWG.  
 B = 480 V TRAINLINE CONNECTOR } C-05-7171  
 C = 27 POINT MU TRAINLINE CONNECTOR } (B)



\* APPROXIMATE LOCATIONS FOR JUNCTION BOXES (PREFERRED)  
 SPACE REQUIREMENTS MAY DICTATE FINAL LOCATION OTHERWISE  
 Δ MU SYSTEM OPTIONAL

**FIGURE 4**

(B) REV B 10-87

**H.E.P. CAR  
 JUNCTION BOX AND  
 CABLE ARRANGEMENT**

SCALE: 1/4" = 1'-0"

2044