AMTRAK PRIVATE CAR

H.E.P. CONVERSION FOR

CONVENTIONAL CARS MANUAL

Amtrak®

AMTRAK PRIVATE CAR H.E.P. CONVERSION FOR CONVENTIONAL CARS MANUAL

SECTION I

INSPECTION OF PRIVATE OWNED CARS
S.M.P.

AMTRAK EQUIPMENT MAINTENANCE DEPARTMENT

STANDARD MAINTENANCE PROCEDURE

SMP NO. 28603

ISSUE DATE: January 12, 1982

REVISION DATE: April 1, 1989

TITLE INSPECTION OF PRIVATE CARS

EQUIPMENT TYPE PRIVATELY-OWNED PRIVATE CARS

STANDARD FOR HANDLING PRIVATELY-OWNED CARS IN AMTRAK TRAINS

SCOPE

This document describes Amtrak's requirements for the handling of privately-owned cars in Amtrak trains. Carriers may impose additional requirements.

PROCEDURE

I. (A) The cars must comply with applicable section of the current edition of A.A.R. Car Rules, and all sections of the S.M.P. The cars will be subjected to a twelve month inspection from last inspection and certification by Amtrak Mechanical Department or its authorized representative. A copy of PC1 is to be retained in the car electric locker.

(B) Cars must be equipped with CS, H, F or T coupler on both ends of the cars. Cars must be equipped with roller bearings. Cars must have steam connectors removed. Inspection of private cars can be made at an Amtrak car facility with advance arrangement with the facility manager. This inspection will be at owner's expense. Movement to Amtrak facility will be at owner's expense and, if car is not approved for movement in Amtrak service, car must be removed from Amtrak facility within seven 7 days at owner's expense. Annual (PC1) inspection may be made at any location that owner designates by an Amtrak authorized inspector. If car is found unfit for movement in Amtrak service, car owner will be advised in writing of defects necessary to correct before car can be reinspected for Amtrak's certification. Amtrak will not be required to make such repairs. The cost of all labor and materials consumed by Amtrak or the operating railroad in inspecting private cars will be at owner's expense.

(C) Any cost incurred in making an inspection and repairs to comply with the intent of this section will be for the account of the car owner. Routine inspections that occur prior to or during train movement are not chargeable to the owner.

(D) Cars must be equipped with one or more marker lights that comply with 49 CFR Part 221, Rear End Marking Device. The marker lights must have a battery back up source that will burn for at least 2 hours.

(E) Cars must be equipped with foot plates on both ends and be compatible with Amtrak equipment. If car is not equipped with foot plate on observation end, will be restricted to first or rear passenger carrying car in train. Cars not complying with paragraph are not guaranteed rear position.

(F) Private cars when on Amtrak trains or Amtrak property must display Amtrak I.D. number (800,000 series) as per Amtrak Drawing Number A-002-5079.

(G) The maximum electrical load capacity on private cars when using H.E.P. cannot exceed 85 kw effective July 1, 1986.

(H) Prior to first movement in Amtrak trains, a clearance form, MAP-PC-5-Rev. must be completed and sent as instructed on form. Any changes to the configuration, which alters the dimensions on file must be reported with new form.

(I) The car owner will maintain a continuous record of all repairs and modifications on PC-4 shop report. This report will be sent in with PC1 annually.

(J) On completion of the twelve month inspection (PC1) the owner will forward a copy of PC1, PC1A, PC3 and PC4 forms to superintendent of cars (private cars) copies of all PC forms must be kept in electrical locker.

(K) Effective January 1, 1991 cars must be equipped with Amtrak full 480 HEP pass through and 27 point communication system and main reservior line.

(L) Cars equipped with cushion draft gear must be locked in buff position with 1" freeslack in Amtrak train service.

(M) All work performed must comply with all aspects to the applicable standards recommended practices adopted by A.A.R.

(N) Cars which must operate on the rear because of lack of diaphragms, foot plates, full H.E.P. 27 point communication main reservior, are subject to cutoff or set out without notice due to operational problems.

(O) When any private car is shopped at any Amtrak facility, the following information must be entered in the ARROW system computer:

1. Date shopped and defects.

2. Date released.

3. Repairs made on car.

(P) Cars equipped with ABDW brake are limited to no more than 2 cars per train and not in consecutive order in train consist.

II. Cars over 40 years old

In addition to the provisions of item #1 above, the following will apply.

(A) The car must undergo a detailed inspection (as described on attached PC1 and PC2 forms and their instructions) by the Mechanical Departments of Amtrak, an Amtrak carrier or an authorized Amtrak Inspector Representative. The first inspection shall occur within the 40th year from date built. After the initial 40 year inspection, the following inspection schedules and related instruction shall be followed. Cars that have received a previous 40 year inspection will be due another 40 year inspection 6 years from that inspection date using Form PC2 and PC2 instructions.

(1) 200,000 miles from 40 year inspection car will be inspected using MAP PC2A and PC2A instructions.

(2) 350,000 miles from 40 year inspection car will be inspected using MAP PC2A and PC2A instructions.

(3) 500,000 miles from 40 year inspection car will be inspected using MAP PC2A and PC2A instructions.

(4) In a ten year period if car does not meet mileage criteria, car must be inspected using Form PC2A and PC2A instructions regardless of the mileage.

(B) The car owner will maintain a log of non-Amtrak routes and mileage traveled (PC3 route mileage log). Amtrak will maintain route mileage record in Amtrak ARROW system for mileage requirements.

(C) On completion of the 40 year inspection and related inspections, the owner will forward copies of all PC forms to Superintendent Cars (private cars) office for file.

III. Cars converted to run with Amtrak head-end power train consists:

(A) Cars must meet Amtrak specifications for head-end power conversion.

(B) All materials used in H.E.P. conversion must meet Amtrak specifications.

(C) Final testing and approval of the H.E.P. conversion will be done at Amtrak facility. Inspection charge shall not exceed 1 hour.

(D) If the H.E.P. 480 volt conversion is applied to only one side of the car, the car may only operate on the rear of the train consist. A car equipped with H.E.P. on both side may not operate behind a car equipped on one side. No more than three (3) cars equipped with H.E.P. on one side may operate in a train. Exceptions to the three (3) car maximum will be considered on a case-by-case basis.

Cars not complying with paragraph are not guaranteed rear position.

(E) If the car has no main reservoir line through car or no 27-point communication line through the car, it may operate only on the rear.

(F) Single line schematic or equal depicting all loads fed from head end power must be maintained and furnished to Amtrak upon completion of head end power installation.

(G) On completion of the H.E.P. conversion, a new clearance diagram PC5 Rev. must be completed and furnished to Amtrak.

PRIVATE CAR ANNUAL INSPECTION REPORT

AMTRAK ID NO. _____ CAR NAME/NUMBER _____ DATE BUILT _____

LUBE DATE _____ TYPE COUPLER A _____ B _____

AB TYPE _____ C.O.T.&S. DATE - LOC. _____

INSPECTION DATE _____ LOCATION _____

OWNERS NAME _____

ADDRESS _____ PHONE NO. _____

AMTRAK AUTHORIZED INSPECTOR NAME _____

TITLE _____ ADDRESS _____

COMPANY _____ BUSINESS PHONE NUMBER _____

Initial on each line denotes compliance or notes defect. Car not equipped should be marked N/A on line. Car must have defects repaired before submitting movement request.

		Initial
1.	Check bearings for signs of overheating and bearing seals for leaking.	
2.	Check past due roller bearing lubrication dates. *Oil - 30 Day Grease - 90 Day - AP bearing 1 year (not necessary to lube NFL).	
3.	Check for defective roller bearing boxes *cracked - excessive wear or broken.	
4.	Check roller bearing cap screws and lock plates/safety wire.	
5.	Check pedestal jaws and liners for visible defects - *broken-loose-bent and broken weld.	
6.	Check journal box stop for securement *Loose or missing.	
7.	Check air brake past due COTS UC 15 months, D22-24 months, 26C 36 months, ABD ABDW 6 years, ABDG-3 years.	
8.	Check brake pipe hose A&B end *8 years old overdue or damaged.	

		Signature
9.	Check main reservoir hoses A&B ends. *Eight years old overdue or damaged.	
10.	Inspect, test hand brake for proper operation and stencil date and location tested.	
11.	Visually inspect under car equipment. *Equipment securement, loose pipes, frayed wires, etc.	
12.	Visual inspection of equalizers, shock absorbers, swing hangers, springs, truck frames and spring planks for unusual wear or defective conditions. *Cracked, broken collapsed springs, shiny/rubbing area, loose bolsters anchor rods.	
13.	Visual inspection of axles and brake discs for defects. Check spicer drive unit for proper amount of lubrication (dip stick level). Inspect drive shaft clutch and spicer. *Loose/cracked discs, loose bolts, check play in universal joints and grease. Cracked disc comply with Amtrak Drawing No. A-007087.	
14.	Check brake shoes to ensure adequate service and in alignment and proper application. 1/2" Amtrak standard on disc pads. 3/4" on tread shoes.	
15.	Steam connector removed and remaining pipe properly secured.	
16.	Visual inspection of couplers and components. Check operating rod clearance, maximum height 35", preferred height 34 1/2", minimum height 34". *Worn knuckles, loose carrier iron bolts, broken springs.	
17.	Inspect and check operation of diaphragm, buffer, suspension rods, springs A&B ends. *Buffer height is 53" from top of rail.	
18.	Check slack adjuster, brake rigging, bushings, brake cylinders and brake heads. Loose bolts, pins and worn bushings.	
19.	Check sill steps, hand holds and other safety appliances for compliance with FRA/AAR Safety Appliance Standards. *Hand holds must have minimum clearance of 2".	
20.	Amtrak ID number on left and right side B-end or blind end, Amtrak Drawing A-002-5079, 54" from top of rail.	
21.	Marker light FRA approved 49CFR Part 221, rear end marking device with battery back up source. Batteries should be self-contained for back up source. Water tight container.	

		*	Signature
22.	Car that has been converted to 480 H.E.P. will have exposed 480 cables (wiring) inspected for defect and deterioration in the insulation. *Debris damage cracking or fraying of insulation.	*	
23.	Check call Bell A&B end for proper operation.	*	
24.	Car equipped with 480 volt H.E.P. One Side Only _____ A End ___ B End ___ Both Sides _____	*	
25.	Car equipped with 27-point communication system. One Side Only _____ A End ___ B End ___ Both Sides _____	*	
26.	Car equipped with MU control lines. Yes No	*	
27.	Verify that PC-5 Clearance Form when last filed the exterior measurements have not changed. Yes No	*	
28.	Gauge all wheels and record dimensions in 16th or 64ths. Inspect for other defects.	*	

WHEEL NO.	RIM THICKNESS	FLANGE HEIGHT	FLANGE THICKNESS
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

*Note the star items are only a suggested defect list and not complete.

I certify each item on the PC form was inspected by me and found in compliance.

Inspector Signature _____

Date of Inspection _____

PRIVATE CAR 40 YEAR OR OLDER INSPECTION

AMTRAK ID NO. _____

CAR NAME/NUMBER _____ DATE BUILT _____

LUBE DATE _____ C.O.T.&S. DATE _____

OWNERS NAME _____

STREET ADDRESS _____ PHONE NO. _____

CITY _____ STATE _____ ZIP CODE _____

AMTRAK AUTHORIZED INSPECTOR NAME _____

TITLE _____ ADDRESS _____

COMPANY _____ BUSINESS PHONE NUMBER _____

Map inspection and repairs must comply with attached instructions by item numbers listed.

	Inspector's Signature *Note: This inspection when trucks torn down.*	* Final Inspection Signature Trucks under car and all work complete.*
1. Jack car and remove trucks.		
2. Clean and inspect truck bolsters, body bolsters, bolster center plates, and top center plates.		
3. Remove swing hangers and pins (6 wheel truck). Remove swing hangers, crossbars and pins (4 wheel truck).		
4. Clean and inspect swing hangers and crossbars.		
5. Remove equalizer bars, springs and spring seats.		

		Inspector's Signature *Note: This inspection when trucks torn* *down.	* Final Inspection Signature Trucks under car and all work complete.
6.	Clean and inspect equalizer bars.	* *	* *
7.	Clean and inspect equalizer spring.	* *	* *
8.	Test springs for resiliency, cracks or broken.	* *	* *
9.	Clean and inspect spring seats.	* *	* *
10.	Clean and inspect truck frame and spring planks.	* *	* *
11.	Clean and inspect pedestal liner.	* *	* *
12.	Clean and inspect anchor bars, anchor bar bolts and rubber bushings.	* * *	* * *
13.	Inspect wheels, axles and roller bearing boxes.	* *	* *
14.	Clean and inspect brake rigging, pins, levers, bushings and component parts.	* * *	* * *
15.	Clean and inspect and gauge coupler and coupler operation rods.	* * *	* * *
16.	Inspect draft gear for excessive slack.	* *	* *
17.	Remove draft gear pan *Clean and inspect area around draft gear.	* * *	* * *
18.	Inspect battery boxes, air conditioning units, electrical breaker boxes, equipment boxes and all other boxes attached to car.	* * * * *	* * * * *
19.	Inspect all areas where boxes are attached.	* *	* *
20.	Inspect generators, generator supports and securing devices.	* * *	* * *
21.	Inspect cables, wiring and conduit on cars with 480 power and 27 point train line systems.	* * * *	* * * *

		Inspector's Signature *Note: This inspection when trucks torn* *down.	* Final Inspection Signature Trucks under car and all work complete.
22.	Inspect marker lights for proper operation.	* *	* *
23.	Test and inspect all air lines and main reservoir lines for leaks.	* * *	* * *
24.	Single car test car for proper brake operation.	* *	* *
25.	Inspect, test and stencil hand brake.	* *	* *
26.	Inspect all hand holds for proper clearance, application and worn conditions.	* * *	* * *
27.	Inspect all trap doors for proper securement.	* *	* *
28.	Inspect all entrance steps for proper securement and conditions of step treads and risers.	* * * *	* * * *

I certify each item on the PC form was inspected by me and found in compliance.

Inspector Signature _____

Date of Inspection _____

INSTRUCTIONS FOR PRIVATE CARS 40 YEARS OR OLDER INSPECTION FOR COMPLIANCE OF MAP PC2

1. Jack car and remove and replace trucks.

2. *Clean and inspect truck bolsters, body bolster, bolster center plates and top center plates. Must comply with instructions and requirements of SMP 46617 and SMP 48001.

3. Remove swing hangers and pins (6 wheel truck). Remove swing hangers, crossbars and pins (4 wheel truck).

4. *Clean and inspect swing hangers and crossbars. Must comply with instructions and requirements of SMP 46605 except not necessary to Brinell test must Magna-Flux or Dye Check. Renew swing hanger bushings worn 10% of new. Renew swing hanger pins worn 10% of new.

5. Remove equalizer bars, springs and spring seats.

6. *Clean and inspect equalizer bars. Must comply with instructions and requirements of SMP 46617 and SMP 46603 except not necessary to Brinell test, must Magna-Flux or Dye Check.

7. *Clean and inspect equalizer springs.

8. Test springs for resiliency, cracks, or broken springs. Must be renewed if weak, cracked, or broken.

9. *Clean and inspect equalizer spring seat. Must comply with instructions and requirements of SMP 46617 and SMP 49602. Must Magna-Flux or Dye Check.

10. *Clean and inspect truck frame and spring plank. Must comply with instructions and requirements of SMP 46617 and SMP 48001 and tramming instructions. Truck frame bushings must be renewed when worn 10% of new.

11. *Clean and inspect pedestal liners for cracks in the parent material or in welds holding liners to truck frame. Maximum allowable clearance between pedestal liners and journal housing 1/8" total each box. The following lateral clearances total per wheel set between thrust lugs of journal housing and pedestal liners is a minimum of 3/8" and a maximum of 5/8". The middle pair of wheels on a six (6) wheel truck. The following lateral clearance per wheel set between thrust lugs of journal housing and pedestal liners is a minimum of 5/8" and a maximum of 3/4". If liners are cracked or worn, they must be renewed. To determine if wear is in pedestal liner or journal box liner, the measurements must be made previous to dismantling of truck, all cracked welds must be properly repaired to ensure proper securement.

12. *Clean and inspect anchor bars, anchor bar bolts and rubber bushings. Cracked or broken anchor bars must be renewed, anchor bar bolts worn 15% or have pulled or worn threads must be renewed and anchor bar rubber bushing worn or aged, cracked must be renewed.

13. (A) Inspect wheels and axles in accordance with applicable AAR Manual, Standard and Recommended Practices (Section G, Part II). In addition, any wheel with flange height of 1 1/4" or more must be restored to full contour, any wheel with flange thickness of 1" or less must be restored to full contour and any wheel with 5/16" or less above passenger scrap must be renewed. Note: If spicer drive is not used, remove from axle.

(B) Inspect roller bearings and boxes:

1. Grease lubricated: remove roller bearing face plate (where applicable). Remove journal end cap, visually inspect bearing box and grease fully, rotate box to determine any signs of distress either by sound or feel. Inspect grease for any discoloration. (If grease is discolored, box must be entirely cleaned and new grease applied.)

Reapply journal end caps and torque bolts to proper foot pounds as recommended in (Section H, Part II) Roller Bearing Manual H-II-81). In addition, bolts must be secured with triangular locking plate. Apply roller bearing box plate and secure bolts with wire (where applicable). Grease boxes as recommended in (Section A, Part III) Passenger Car requirements (Section 4.0 of A-III-263).

Hyatt roller bearing boxes: The lateral must be adjusted according to the instruction of Hyatt Roller Bearing Railroad Journal Boxes.

(C) Oil Lubricated.

Hyatt boxes: drain oil, remove boxes from journal, inspect roller bearings, roller bearing cages and clean and flush box with light oil. Remount boxes on journals and fill to capacity with oil as recommended in (Section A, Part III Passenger Car Requirements (Section 4.0 of A-III-263). Wire both fill plug and drain plug.

Hyatt roller bearing boxes: The lateral must be adjusted according to the instruction of Hyatt Roller Bearing Railroad Journal Boxes.

Timken boxes: drain oil, remove face plate, journal end cap, visually inspect bearings and boxes, fully rotate boxes to determine any sign of distress either by sound or feel. Reapply journal end caps and torque bolts to proper foot pounds as recommended in (Section H, Part II) Roller Bearing Manual H-II-81. In addition, bolts must be secured with triangular locking plate, apply roller bearing box face plate and secure bolts with wire. Oil boxes as recommended in (Section A, Part III) Passenger Car Requirements (Section 4.0 on A-III-263). Wire both fill plug and drain plug.

14. *Clean and inspect all brake rigging, pins, levers, bushings and component parts for cracks, broken or worn conditions.

Clasp brake:

(A) renew all brake pins when worn 10% of new.

(B) Renew all bushings when worn 10% of new.

(C) All tread brake shoe heads must be capable of fully holding brake shoe with no side play nor overlap of rim of wheel.

Disc Brake Type:

(A) Inspect all brake tongs, shoe heads, bolts and component parts for cracked, broken, or worn conditions. Remove all shoe heads and inspect shoe head pins for cracks. Cracked shoe head pins must be renewed. Inspect shoe head retaining buttons to ensure they are tight and of full contour. Worn or loose buttons must be renewed. All bolts must have retaining plates or wire.

(B) When equipped with C frames, *clean and inspect C frames for cracks. Rubber back bushing must be renewed.

(C) Inspect rubber donut segments - renew if worn.

(D) All C frames must have safety chains.

15. *Clean, inspect and gauge couplers and operating rods.

(A) Tightlock H or T type coupler must meet AAR Manual of Standards and Recommended Practices (Section A, Part III, Specification 206B-80).

(B) Tightlock F type coupler must meet AAR Manual of Standards and Recommended Practices (Section A, Part III, Specification M209B-74).

(C) Controlled slack type coupler must meet maintenance recommendation of American Steel Foundry Report No. 509A, revised June 19, 1960 and AAR Alternative Standard S-026.

16. Inspect draft gear for excessive slack. Must meet AAR requirement for type of coupler:

    (A) H Type 1/2"

    (B) F Type 1"

    (C) Controlled Slack 1"

    (D) T Type 1"

17. Remove draft gear pan *Clean and inspect area around draft gear for cracks, loose, or worn parts. If any cracks are located, they must be welded and reinforced according to AAR Specifications.

18. Inspect battery boxes, air condition units, electrical breaker boxes, equipment boxes and all other boxes attached to car. Inspect for loose or broken bolts or rivet. Boxes with cracks or broken areas must be repaired and reinforced. All box support straps, cracked or broken must be completely renewed. Loose or broken bolts and rivets must be renewed. They must be renewed with high strength bolts and elastic stop nuts. The tensile strength of the bolts and nuts must be grade 5 or better.

19. Inspect all areas where the boxes are attached for cracks, worn holes, and fatigued metal. Any of the above conditions found must be reinforced.

20. Inspect axle generators, axle generator supports and securing devices for cracks, fatigued metal, and worn holes. If any of the above conditions are found, they must be reinforced. Loose or broken bolts or rivets must be renewed. They must be renewed with high strength bolts and elastic stop nuts. The tensile strength of the bolts and nuts must be grade 5 or better.

    (A) Belt driven generators must have axle pulley inspected for cracks, proper mounting and secured with proper bolts. All cracked pulleys must be renewed. Inspect all belts for loose, worn and damage. Replace as required.

    (B) Generators with spicer drive, clutch and drive shaft must be inspected for worn companion flanges, loose and worn drive shafts. If any of the above conditions are found, they must be renewed. Drive shaft must have safety hangers and have safety hangers in good condition. Note: If spicer not used, must be removed.

    (C) Inspect torque arm for excessive play. If any play exists, the torque arm bushings must be renewed (there must be no slack).

    (D) Spicer drive must have safety arm.

(E) Check spicer drive for proper oil level and lubricate univeral joints on drive shaft.

21. Inspect cables, wiring and conduit of cars with 480 power 27 point train line systems and head end power systems. Wires and cables with cuts or abrasions, any conduit broken, loose or cracked must be repaired to meet Amtrak engineering specifications.

22. Inspect marker lights for proper operation. All cars must have the capabilities of burning 2 hours with loss of power.

23. Inspect and test with soap suds all air lines and main reservoir lines for leaks. All loose pipes must be tightened and all cracked and broken pipes must be renewed. Inspect all air hoses and main reservoir hoses for defects.

24. Single car: test cars for proper brake operation and proper piston travel. Must pass single car test according to AAR Specification Instruction Pamphlet No. 5039-4. Piston travel body mounted cylinders 7". Truck mounted cylinders 5".

25. Inspect, test and stencil handbrake for proper operation. Handbrake must apply and release properly and work in conjunction with the airbrake. Handbrake must be located so it can safely be operated while car is in motion. Lubricate all sheave wheel pins.

26. Inspect all hold holds for proper clearance, application and worn conditions. Hand holds must be constructed of minimum 5/8" diameter, must be tight, free of breaks and cracks and a minimum "clearance of 2". Cracked or broken hand hold must be renewed and comply with FRA Requirements.

27. Inspect all trap door catches for proper securement. Must not be loose and must be secured with tapped bolts of not less than 1/4". Trap door must raise enough to clear locking device when opening to ensure sufficient clearance to avoid personal injury to hands.

28. Inspect all entrance steps for proper securement and conditions of step treads and risers. They must not be loose, cracked or broken. All loose steps must be secured with high strength bolts and elastic stop nuts. Risers broken or cracked must be renewed with a minimum 1/4", wrought iron or steel. Step treads must have a nonskid tread.

*Any cleaning of areas can be done with any of the following methods: sand or grit blasting, walnut shelling, wire brushing or high pressure steam cleaning or high pressure water.

MAP PC2A
SMP No. 28603

(Requires PC-1, PC-1A,
PC-3, PC-4)

PRIVATE CAR 200,000 MILE INSPECTION
AFTER AMTRAK 40 YEAR INSPECTION

AMTRAK ID NO. _____

CAR NAME/NUMBER _____ DATE LAST 40 YEAR INSPECTION (PC2) _____

LUBE DATE _____ C.O.T.&S. DATE _____

OWNERS NAME _____

STREET ADDRESS _____ PHONE NO. _____

CITY _____ STATE _____ ZIP CODE _____

AMTRAK AUTHORIZED INSPECTOR NAME _____

TITLE _____ ADDRESS _____

COMPANY _____ BUSINESS PHONE NUMBER _____

Map inspection and repairs must comply with attached instructions by item numbers listed.

	Inspector's Signature *Note: Truck out from* *under car.	Final Inspection Signature Truck applied to car.
1. Jack car and remove trucks.		
2. Inspect truck bolsters, body bolsters, bolster center plates and top center plates.		
3. Inspect swing hangers, cross bars and pins		
4. Inspect equalizer bars.		
5. Inspect equalizer springs and equalizer spring seats.		
6. Inspect truck frame.		

		Inspector's Signature *Note: Truck out from* *under car. *	* Final Inspection Signature * Truck applied to * car.
7.	Inspect pedestal liners.		
8.	Inspect anchor bars, anchor bar bolts and rubber bushings.		
9.	Inspect wheels and axles and roller bearing boxes.		
10.	Inspect all brake rigging pins, levers, bushings and component parts.		
11.	Inspect and gauge couplers and coupler operating rods.		
12.	Inspect draft gear for excessive slack.		
13.	Inspect area around draft gear.		
14.	Inspect battery boxes, air conditioning units, electrical breaker boxes, equipment boxes and all other boxes attached to car.		
15.	Inspect all areas where the boxes are attached for cracks, worn holes and fatigued metal.		
16.	Inspect generators, generator supports and securing devices.		
17.	Inspect cables, wiring and conduit on cars with 480 power and 27 point train line systems.		
18.	Inspect marker lights for proper operation.		
19.	Test and inspect all air lines and main reservoir lines for leaks.		
20.	Single car test car for proper brake operation.		
21.	Inspect, test and stencil hand brake.		

		Inspector's Signature *Note: Truck out from* *under car. *	* Final Inspection Signature * Truck applied to * car.
22.	Inspect all hand holds for proper clearance, application and worn conditions.	* * *	* * *
23.	Inspect all trap doors for proper securement.	* *	* *
24.	Inspect all entrance steps for proper securement and conditions of step treads and risers.	* * * *	* * * *

I certify each item on the PC form was inspected by me and found in compliance.

Inspector Signature _____

Date of Inspection _____

PRIVATE CAR 350,000 MILE INSPECTION
AFTER AMTRAK 40 YEAR INSPECTION

AMTRAK ID NO. _____

CAR NAME/NUMBER _____ DATE LAST 40 YEAR INSPECTION (PC2) _____

LUBE DATE _____ C.O.T.&S. DATE _____

OWNERS NAME _____

STREET ADDRESS _____ PHONE NO. _____

CITY _____ STATE _____ ZIP CODE _____

AMTRAK AUTHORIZED INSPECTOR NAME _____

TITLE _____ ADDRESS _____

COMPANY _____ BUSINESS PHONE NUMBER _____

Map inspection and repairs must comply with attached instructions by item numbers listed.

	Inspector's Signature *Note: Truck out from* *under car.	Final Inspection Signature * Truck applied to car.
1. Jack car and remove trucks.		
2. Inspect truck bolsters, body bolsters, bolster center plates and top center plates.		
3. Inspect swing hangers, cross bars and pins		
4. Inspect equalizer bars.		
5. Inspect equalizer springs and equalizer spring seats.		
6. Inspect truck frame.		

		Inspector's Signature *Note: Truck out from* *under car. *	* Final Inspection Signature * Truck applied to * car.
7.	Inspect pedestal liners.		
8.	Inspect anchor bars, anchor bar bolts and rubber bushings.		
9.	Inspect wheels and axles and roller bearing boxes.		
10.	Inspect all brake rigging pins, levers, bushings and component parts.		
11.	Inspect and gauge couplers and coupler operating rods.		
12.	Inspect draft gear for excessive slack.		
13.	Inspect area around draft gear.		
14.	Inspect battery boxes, air conditioning units, electrical breaker boxes, equipment boxes and all other boxes attached to car.		
15.	Inspect all areas where the boxes are attached for cracks, worn holes and fatigued metal.		
16.	Inspect generators, generator supports and securing devices.		
17.	Inspect cables, wiring and conduit on cars with 480 power and 27 point train line systems.		
18.	Inspect marker lights for proper operation.		
19.	Test and inspect all air lines and main reservoir lines for leaks.		
20.	Single car test car for proper brake operation.		
21.	Inspect, test and stencil hand brake.		

		Inspector's Signature *Note: Truck out from* *under car. *	Final Inspection Signature * Truck applied to * car.
22.	Inspect all hand holds for proper clearance, application and worn conditions.	* * *	* * *
23.	Inspect all trap doors for proper securement.	* *	* *
24.	Inspect all entrance steps for proper securement and conditions of step treads and risers.	* * * *	* * * *

I certify each item on the PC form was inspected by me and found in compliance.

Inspector Signature _____

Date of Inspection _____

PRIVATE CAR 500,000 MILE INSPECTION AFTER AMTRAK 40 YEAR INSPECTION

AMTRAK ID NO. _____

CAR NAME/NUMBER _____ DATE LAST 40 YEAR INSPECTION (PC2) _____

LUBE DATE _____ C.O.T.&S. DATE _____

OWNERS NAME _____

STREET ADDRESS _____ PHONE NO. _____

CITY _____ STATE _____ ZIP CODE _____

AMTRAK AUTHORIZED INSPECTOR NAME _____

TITLE _____ ADDRESS _____

COMPANY _____ BUSINESS PHONE NUMBER _____

Map inspection and repairs must comply with attached instructions by item numbers listed.

	Inspector's Signature *Note: Truck out from* *under car.	Final Inspection Signature Truck applied to car.
1. Jack car and remove trucks.		
2. Inspect truck bolsters, body bolsters, bolster center plates and top center plates.		
3. Inspect swing hangers, cross bars and pins		
4. Inspect equalizer bars.		
5. Inspect equalizer springs and equalizer spring seats.		
6. Inspect truck frame.		

		Inspector's Signature *Note: Truck out from* *under car. *	* Final Inspection Signature * Truck applied to * car.
7.	Inspect pedestal liners.		
8.	Inspect anchor bars, anchor bar bolts and rubber bushings.		
9.	Inspect wheels and axles and roller bearing boxes.		
10.	Inspect all brake rigging pins, levers, bushings and component parts.		
11.	Inspect and gauge couplers and coupler operating rods.		
12.	Inspect draft gear for excessive slack.		
13.	Inspect area around draft gear.		
14.	Inspect battery boxes, air conditioning units, electrical breaker boxes, equipment boxes and all other boxes attached to car.		
15.	Inspect all areas where the boxes are attached for cracks, worn holes and fatigued metal.		
16.	Inspect generators, generator supports and securing devices.		
17.	Inspect cables, wiring and conduit on cars with 480 power and 27 point train line systems.		
18.	Inspect marker lights for proper operation.		
19.	Test and inspect all air lines and main reservoir lines for leaks.		
20.	Single car test car for proper brake operation.		
21.	Inspect, test and stencil hand brake.		

		Inspector's Signature *Note: Truck out from* *under car. *	* Final Inspection Signature * Truck applied to * car.
22.	Inspect all hand holds for proper clearance, application and worn conditions.	* * *	* * *
23.	Inspect all trap doors for proper securement.	* *	* *
24.	Inspect all entrance steps for proper securement and conditions of step treads and risers.	* * * *	* * * *

I certify each item on the PC form was inspected by me and found in compliance.

Inspector Signature _____

Date of Inspection _____

INSTRUCTIONS FOR PRIVATE CAR INSPECTION 200,000 THROUGH 500,000 MILES AFTER 40 YEARS AMTRAK INSPECTION FOR COMPLIANCE OF MAP PC2A

1. Jack car and remove and replace trucks. Do not disassemble trucks unless necessary to repair defects found.

2. Inspect truck bolsters, body bolsters, bolster center plates and top center plates for worn conditions, cracks or broken. If any defects are noted, they must be repaired to comply with instructions and requirements of SMP 46617 and SMP 48001.

3. Inspect swing hangers, crossbars and pins for worn conditions, cracks or broken. If any defects are noted, they must be repaired to comply with instructions and requirements of SMP 46605 except not necessary to Brinell test must Mana-Flux or dye check. If no defects are found.

4. Inspect equalizer bars for worn conditions, cracks, broken or gauged. If any defects are noted, they must be repaired to comply with instructions and requirements of SMP 46617 and SMP 46603.

5. Inspect equalizer springs and equalizer spring seats for worn conditions, cracks or broken. Broken or cracked equalizer springs must be renewed. Equalizer spring seats must be repaired to comply with instructions and requirements of SMP 46617 and SMP 49602.

6. Inspect truck frame for worn conditions, cracks or broken. If any defects are noted, they must comply with instructions and requirements of SMP 46617 and SMP 48001. Truck frame bushings must be renewed when worn 10% of new.

7. Inspect pedestal liners for cracks and clearance. Maximum allowable clearance is 1/8" between pedestal liners and journal housing. The following lateral clearances total per wheel set between thrust lugs of journal housing and pedestal liners is a minimum of 3/8" and a maximum of 5/8". The middle pair of wheels on a six (6) wheel truck. The following lateral clearance per wheel set between thrust lugs of journal housing and pedestal liners is a minimum of 5/8" and a maximum of 3/4".

8. Inspect anchor bars, anchor bar bolts and rubber bushings. Cracked or broken anchor bars must be renewed, anchor bar bolts with pulled or worn threads must be renewed and anchor bar rubber bushing worn or aged cracked must be renewed.

9. Inspect wheels and axles in accordance with applicable AAR Manual, Standards and Recommended Practices (Section G, Part II). In addition, any wheel with height of 1 1/4" or more must be restored to full contour, any wheel with flange thickness of 1" or less must be restored to full contour and any wheel with 3/16" or less above passenger scrap must be renewed.

   Roller bearing and boxes:

   Remove face plate (where applicable) journal end cap and inspect boxes for any discoloration of grease or oil or any visible bearing problems. Reapply journal end caps and torque bolts to proper foot pounds as recommended in Section H, Part II, Roller Bearing Manual (H-II-81). In addition, bolts must be secured with triangular locking plate. Apply roller bearing box face plate (where applicable) and secure bolts with wire. Grease or oil boxes as recommended in Section A, Part III, Passenger Car Requirements Section 4.0 of A-III-263).

   Hyatt roller bearing boxes:

   The lateral must be adjusted according to the instruction of Hyatt Roller Bearing Railroad Journal Boxes.

10. Inspect all brake rigging, pins, levers, bushings and component parts for cracks, broken or worn conditions.

    Clasp brake:

    (A) renew all brake pins when worn 10% of new.

    (B) Renew all bushings when worn 10% of new.

    (C) All tread brake shoe heads must be capable of fully holding brake shoe with no side play nor overlap of rim of wheel.

    Disc Brake Type:

    (A) Inspect all brake tongs, shoe heads, bolts and component parts for cracked, broken, or worn conditions. Remove all shoe heads and inspect shoe head pins for cracks. Cracked shoe head pins must be renewed. Inspect shoe head retaining buttons to ensure they are tight and of full contour. Worn or loose buttons must be renewed. All bolts must have retaining plates or wire.

    (B) When equipped with C frames, worn or torn rubber back bushings must be renewed.

    (C) Inspect rubber donut segments - renew if worn.

    (D) All C frames must have safety chains.

11. Inspect and gauge couplers and operating rods.

    (A) Tightlock H or T type coupler must meet AAR Manual of Standards and Recommended Practices (Section A, Part III, Specification M 206B-80).

    (B) Tightlock F type coupler must meet AAR Manual of Standards and Recommended Practices (Section A, Part III, Specification M 209B-74).

    (C) Controlled slack type coupler must meet maintenance recommendation of American Steel Foundry Report No. 509A, revised June 19, 1960 and AAR Alternative Standard S-026.

12. Inspect draft gear for excessive slack. Must meet AAR requirement for type of coupler:

    (A) H Type 1/2"

    (B) F Type 1"

    (C) Controlled Slack 1"

    (D) T Type 1"

13. Thoroughly inspect area around around draft gear for cracks, loose, or worn parts. If any cracks are located, they must be welded and reinforced.

14. Inspect battery boxes, air condition units, electrical breaker boxes, equipment boxes and all other boxes attached to car. Inspect for loose or broken bolts or rivet. Boxes with cracks or broken areas must be repaired and reinforced. All box support straps, cracked or broken must be completely renewed. Loose or broken bolts and rivets must be renewed. They must be renewed with high strength bolts and elastic stop nuts. The tensile strength of the bolts and nuts must be grade 5 or better.

15. Inspect all areas where the boxes are attached for cracks, worn holes, and fatigued metal. Any of the above conditions found must be reinforced.

16. Inspect axle generators, axle generator supports and securing devices for cracks, fatigued metal, and worn holes. If any any of the above conditions are found, they must be reinforced to meet Amtrak engineering specifications. Loose or broken bolts or rivets must be renewed. They must be renewed with high strength bolts and elastic stop nuts. The tensile strength of the bolts and nuts must be grade 5 or better.

    (A) Belt driven generators must have axle pulley inspected for cracks, proper mounting and secured with proper bolts. All cracked pulleys must be renewed. Inspect all belts for loose, worn or damage. Replace as required.

    (B) Generators with spicer drive, clutch and drive shaft must be inspected for worn companion flanges, loose and worn drive shafts.

If any of the above conditions are found, they must be renewed. Drive shaft must have safety hangers and have safety hangers in good condition. Note: If spicer not used, must be removed.

(C) Inspect torque arm for excessive play. If any play exists, the torque arm bushings must be renewed (there must be no slack).

(D) Spicer drive must have safety arm.

(E) Check spicer drive for proper oil level and lubricate universal joints on drive shaft.

17. Inspect cables, wiring and conduit of cars with 480 power 27 point train line systems and head end power systems. Wires and cables with cuts or abrasions, any conduit broken, loose or cracked must be repaired to meet Amtrak engineering specifications.

18. Inspect marker lights for proper operation. All cars must have the capabilities of burning 2 hours with loss of power.

19. Inspect and test with soap suds all air lines and main reservoir lines for leaks. All loose pipes must be tightened and all cracked and broken pipes must be renewed. Inspect all air hoses and main reservoir hoses for defects.

20. Single car: test cars for proper brake operation and proper piston travel. Must pass single car test according to AAR Specification Instruction Pamphlet No. 5039-4. Piston travel body mounted cylinders 7". Truck mounted cylinders 4".

21. Inspect, test and stencil handbrake for proper operation. Handbrake must apply and release properly and work in conjunction with the airbrake. Handbrake must be located so it can safely be operated while car is in motion. Lubricate all sheave wheel pins.

22. Inspect all hold holds for proper clearance, application and worn conditions. Hand holds must be constructed of minimum 5/8" diameter, must be tight, free of breaks and cracks and a minimum clearance of 2". Cracked or broken hand hold must be renewed and comply with FRA Requirements.

23. Inspect all trap door catches for proper securement. Must not be loose and must be secured with tapped bolts of not less than 1/4". Trap door must raise enough to clear locking device when opening to ensure sufficient clearance to avoid personal injury to hands.

24. Inspect all entrance steps for proper securement and conditions of step treads and risers. They must not be loose, cracked or broken. All loose steps must be secure with high strength bolts and elastic stop nuts. Risers broken or cracked must be renewed with a minimum 1/4", wrought iron or steel. Step treads must have a nonskid tread.

AMTRAK EQUIPMENT MAINTENANCE DEPARTMENT

STANDARD MAINTENANCE PROCEDURE

SMP NO. : 46617

ISSUE DATE : April 1, 1989

REVISION DATE :

TITLE : Heavy Truck Overhaul Procedure

EQUIPMENT TYPE: Private Car Non-Amtrak Owned.

A. General

1. Trucks are dismantled and parts tagged except brake beams. This is done to ensure that all parts go back into the same truck assembly after overhaul. Completed trucks are returned to the same cars they came off of.

B. Procedures

In addition to the following, components must be reworked to the appropriate SMP (Standard Maintenance Procedure) as noted.

1. Truck Frames

a. Remove pedestal liners.
b. Clean and grit blast.
c. Visually inspect for defects.
d. Areas subject to high stresses (e.g., holes, fillets, and sudden changes in cross-sectional areas) are to be dye checked and inspected for fractures or worn areas.
e. Cracks are to be ground smooth or scarfed out and repair welded. Repair welds are to be ground smooth.
f. Weld repairs are to be dye checked and inspected for fractures.
g. Pedestals must be gauged and inspected. Worn areas must be built up with weld. Repair welds that are visible after truck assembly are to be ground smooth.
h. After repairs are completed, check the tram for the following procedure:

(1) Positioning Truck Frame: On a faceplate or other level surface, invert the truck frame and level with jacks at spring seat locations.

(2) Horizontal Pedestal Alignment: The bottom of the pedestals were machined to a common plane or base line. Check the horizontal alignment of all pedestals with a straight edge.

The normal out of plane service limit is 1/8", that is, the vertical distance from the bottom of one pedestal to the bottom of any other pedestal should not be greater than 1/8".

(3) Pedestal Lean: Each pedestal should be checked for leaning condition to determine out of square position. The pedestals are checked using a straight edge or square. Refer to paragraph for alignment criteria.

(4) Transverse Pedestal Spacing: The transverse pedestal spacing refers to dimension between the inside machined surfaces of pedestal legs on opposite sides of the truck. The nominal tolerance is + or - 1/16".

(5) Longitudinal Alignment: The longitudinal alignment of the pedestal liners on the inside of the pedestal legs, can be checked with a straight edge. Liners are to be in longitudinal alignment within 1/16".

(6) Wheel Base Spacing: Wheel base spacing is the measured longitudinal distance between pedestal legs. For a service limit, the machined faces of pedestals on one side of truck frame are not to exceed 1/8" from opposite side of frame. The wheel base on one side of truck frame to be within 1/8" of wheel base on other side of truck frame.

(7) Tramming Truck Frame: The truck pedestals are trammed to determine if they are in correct alignment with each other, that is to determine if the distance between pedestals are within the allowable dimension service limit.

Tram marks (small punch indications located on the bottom of each pedestal at time of original inspection). These marks are generally located approximately 1/2" in from the face of pedestal and the inner side of pedestal. Tramming is accomplished by using a trammel beam to measure between diagonal tram marks. The service limiting dimension or difference in length of diagonal is 1/8".

2. Bolsters and Spring Planks

a. Clean and gritblast.
b. Inspect visually and magna-flux. Defects found must be thoroughly examined by dye check.
c. Cracks must be ground smooth or scarfed out and welded up per SMP: 48001, "Repair of Grade "A" Truck Frames and Bolsters by Welding" or "Repairing Low Carbon Nickel Steel Truck Frames and Bolsters by Welding."
d. Weld repairs must be dye checked.
e. Spring planks and bolters must be stress-relieved after welding.

3. Spring Seats

a. Clean and gritblast.
b. Inspect visually and magna-flux. Defects found must be thoroughly examined by dye check.
c. Cracks must be ground smooth or scarfed out, repair welded and ground smooth per SMP: 49602, "Repair and Reinforcement of Equalizer Spring Seats."
d. Weld repairs must be dye checked.
e. Spring seats must be stress relieved after welding.

4. Equalizers

For a more detailed procedure, refer to SMP: 46603, "Procedure For Reclaiming Passenger Car Truck Equalizers":

a. Clean and gritblast.
b. Inspect visually and magna-flux. Defects must be thoroughly examined by dye check.
c. Equalizers with defects and worn areas exceeding the allowable limits are to be scrapped.
d. Minor surface defects is possible, will be blended in by grinding.
e. Spring seat area and equalizer feet are to be built up by welding and then ground to original drawing dimensions.
f. When hardness readings are below the minimum allowable, the equalizer may be renormalized and tempered, after which it must be retested for hardness.

5. Brake Beams

a. Clean.
b. Inspect visually and magna-flux. Defects must be thoroughly examined by dye check.
c. Ends must be gauged and if worn/undersized, repair weld and then machine to the proper diameter.
d. Loose or worn bushings must be renewed. Worn holes must be welded and redrilled.

6. Brake Beam Heads, Brake Levers and Rods

a. Clean and gritblast.
b. Inspect visually and magna-flux. Defects found must be thoroughly examined by dye check.
c. Defects and worn areas are to be built up by welding.
d. Apply new bushings.

7. Truck Springs

The following procedures must be used to qualify springs for reuse:

a. Inspect visually. Any spring with broken, missing, or cracked coils must be scrapped.

b. Remaining springs must be cleaned.
c. Springs must be magna-fluxed. Any springs found with defects must be scrapped.
d. Prime or finish paint springs.

8. TFM Brake

Reference; WABCO TFM Disc Brakes, Service Manual and Part Parts Catalog

a. Remove old brake equipment.
b. Assemble fulcrum pivot assembly.

9. 3-AP Decelostat Equipment

a. Overhaul per manufacturer's instructions.

10. Swing Hangers and Cross Bars

Inspect and repair per SMP No. 46605, Reclamation of Truck Crossbars and Swing Hangers.

11. Shock Absorbers

Refer to SMP 46604, "Application of Shock Absorbers".

12. Bolster Anchor Rods

Inspect and repair as required. Renew rubber pads.

13. Center Plates

Remove, inspect and repair. New bolts must be applied. Renew liners and/or pads.

14. CFM Discs Brake Equipment

a. Remove disc brake assembly.
b. Inspect and repair C frame. Renew liners, rubber-backed bearings. Proper C frame must be used.
c. Renew wear plates, pins, bolts, nuts, bushings and liners.
d. Inspect tong assemblies, repair as necessary.
e. Brake heads, inspect and repair as necessary.
f. Apply new brake shoes, brake shoe key, spring and retainer.

PC-1-A
Includes PC-1

PRIVATE CAR DATA

DATE _____

(1000) AMTRAK ID # 800 (100) CAR NAME NUMBER _____ (1002) ORIGINAL DATE BLT. _____

(1003) OWNER _____

ADDRESS _____ PHONE _____

(1004) INSPECTOR _____

ADDRESS _____ PHONE _____

(1005) PC-1 DT:: _____ (1006) PC-1-LOC:: _____
(1007) PC-2 DT:: _____ (1008) PC-2-LOC:: _____
(1009) MAX-SPEED:: 90-110 MPH (1010) CLEARANCE RESTRICTION:: A(NR) B(WEST OF CHIC) C(NOTNY)
(1011) COUPLER TYPE:: _____
(1012) AB TYPE:: _____ (1013) AB DATE: _____ (1014) AB CLEAN BY WHO AND LOCATION: _____
(1015) GEN INFORMATION:: (E.G. dome sleeper lounge diner, etc.) _____

Circle or Answer Every Item

(1016) STANDBY 64V:: YES-NO (1017) NFL BEARING:: YES-NO (1018) EQPD. MAIN RES LINE:: YES-NO
(1019) STANDBY 220V:: YES-NO (1020) LUB GREASE:: YES-NO (1021) 27 PT JUMPER A-END:: YES-NO
(1022) STANDBY 480V:: YES-NO (1023) LUB OIL:: YES-NO (1024) 27 PT JUMPER B-END:: YES-NO
(1025) SELF-CONT ELECTRICAL:: YES-NO (1026) PROPANE:: YES-NO
(1027) 480 EQPD A-END R-SD:: YES-NO (1028) 480 EQPD A-END L-SD:: YES-NO
(1029) 480 EQPD B-END R-SD:: YES-NO (1030) 480 EQPD B-END L-SD:: YES-NO
(1031) DIA-AMF A-END:: YES-NO (1032) DIA AMF B-END:: YES-NO
(1033) DIA SUPERLINER A-END:: YES-NO (1034) DIA SUPERLINER B-END:: YES-NO
(1035) DIA TUBE STYLE A-END:: YES-NO (1036) DIA TUBE STYLE B-END:: YES-NO
(1037) VESTIBULE A-END:: YES-NO (1038) VESTIBULE B-END:: YES-NO
(1039) BLIND END A-END:: YES-NO (1040) BLIND END B-END:: YES-NO
(1041) OPEN PLATFORM A-END:: YES-NO (1042) OPEN PLATFORM B-END:: YES-NO
(1043) ROUND OBSERV. A-END:: YES-NO (1044) ROUND OBSERV. B-END:: YES-NO
(1045) SELF-CONT TOILETS:: YES-NO NUMBER TOILETS ON CAR THAT DUMP ON TRACK _____
(1046) FRA MARKER A-END:: YES-NO (1047) FRA MARKERS B-END:: YES-NO

THIS FORM MUST BE COMPLETED EACH AND EVERY ANNUAL INSPECTION AND SENT WITH THE PC-#1 FORM TO KEEP INFORMATION CURRENT ON FILE.

ALL ITEMS ON FORM MUST BE ANSWERED.

Amtrak

MAP-PC-3

ROUTE/MILEAGE LOG

CAR NAME _____ CAR NUMBER _____ DATE BUILT _____

DEPARTURE DATE	TRAIN NO.	ROUTE [INCLUDE INTERMEDIATE POINTS IF NECESSARY FOR ROUTE IDENTIFICATION]	CARRIER	MILEAGE

SHOP REPORT

AR NAME _____ CAR NUMBER _____ DATE BUILT _____

JOURNAL BEARINGS _____ TRUCKS _____

BRAKE SCHEDULE _____ COUPLERS _____

SHOP LOCATION	SHOP OWNER	DATE IN	DATE OUT	WORK PERFORMED (USE AS MANY LINES AS NECESSARY)	SHOP SUPERINTENDENT

CAR DATA ARE TO BE FULLY RECORDED AT THE TOP OF THIS FORM. KEEP ORIGINAL OF THIS REPORT IN CAR ELECTRICAL LOCKER. FORWARD ONE COPY OF THIS REPORT TO THE AMTRAK CHIEF MECHANICAL OFFICER.

AMTRAK

OFFICE OF THE CHIEF ENGINEER

PRIVATE CAR CLEARANCE DIAGRAM

--REV 2/87--

AMTRAK PRIVATE CAR NO. _____

CAR NAME _____

CAR OWNER _____

ADDRESS _____

_____

PHONE NO. _____

DATE OF MEASUREMENT _____

MEASURED BY _____

INSTRUCTIONS

1. A separate diagram is to be completed for each private car. A new or revised diagram must be submitted following any exterior modifications to the car. Car diagrams must be recertified biannually.

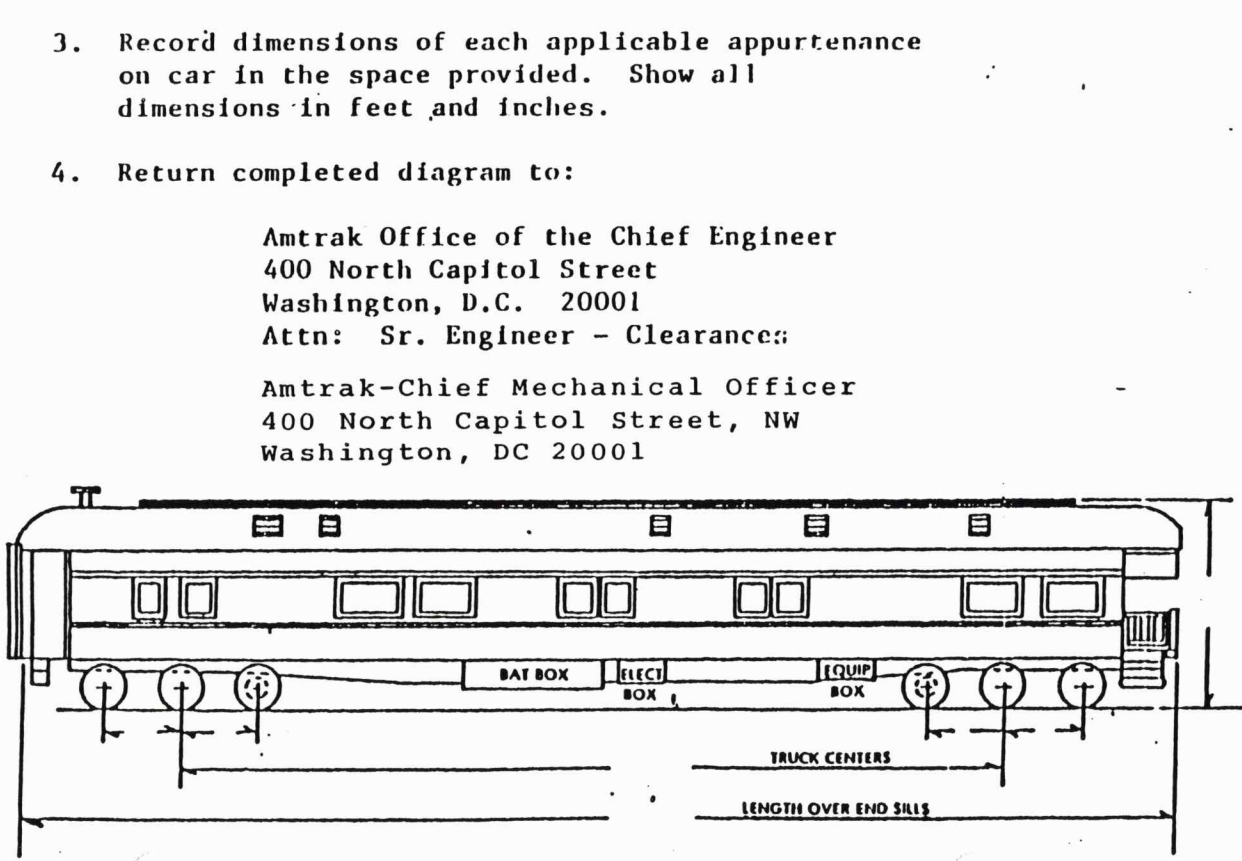
2. Car should be located on level straight track for measurement.

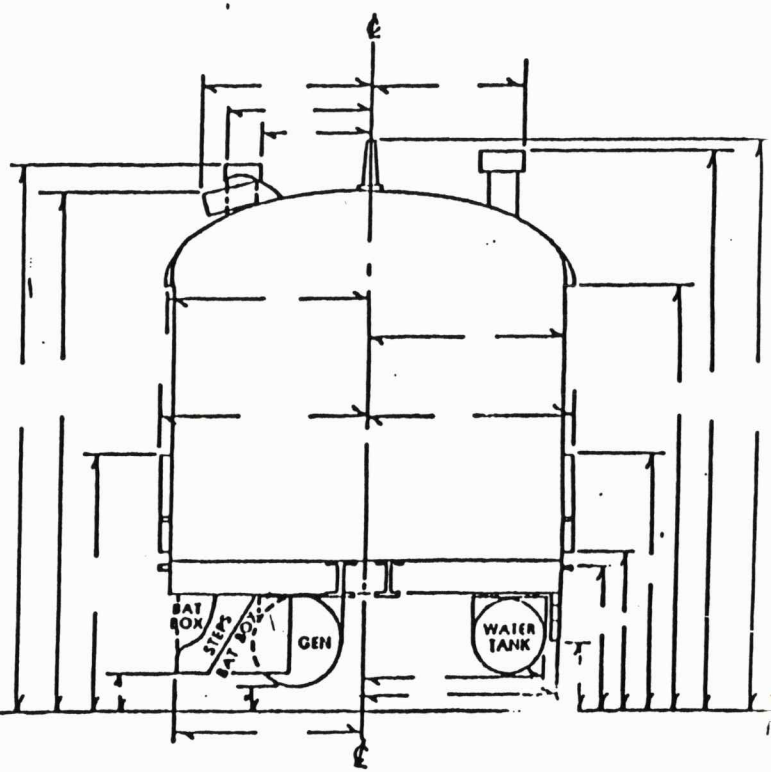
3. Record dimensions of each applicable appurtenance on car in the space provided. Show all dimensions in feet and inches.

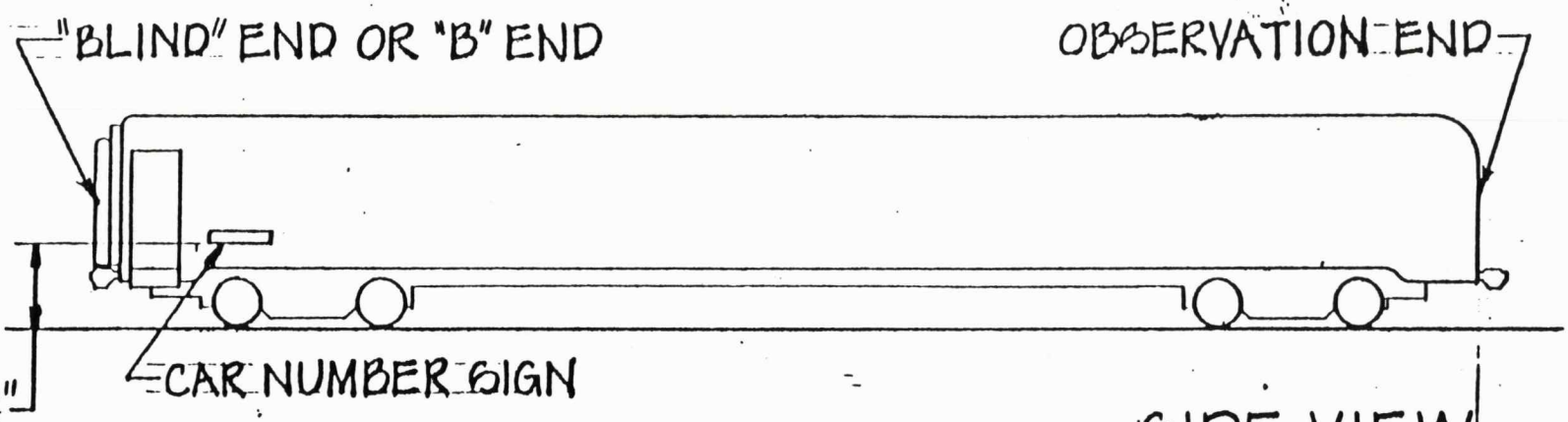
4. Return completed diagram to:

Amtrak Office of the Chief Engineer
400 North Capitol Street
Washington, D.C. 20001
Attn: Sr. Engineer - Clearances

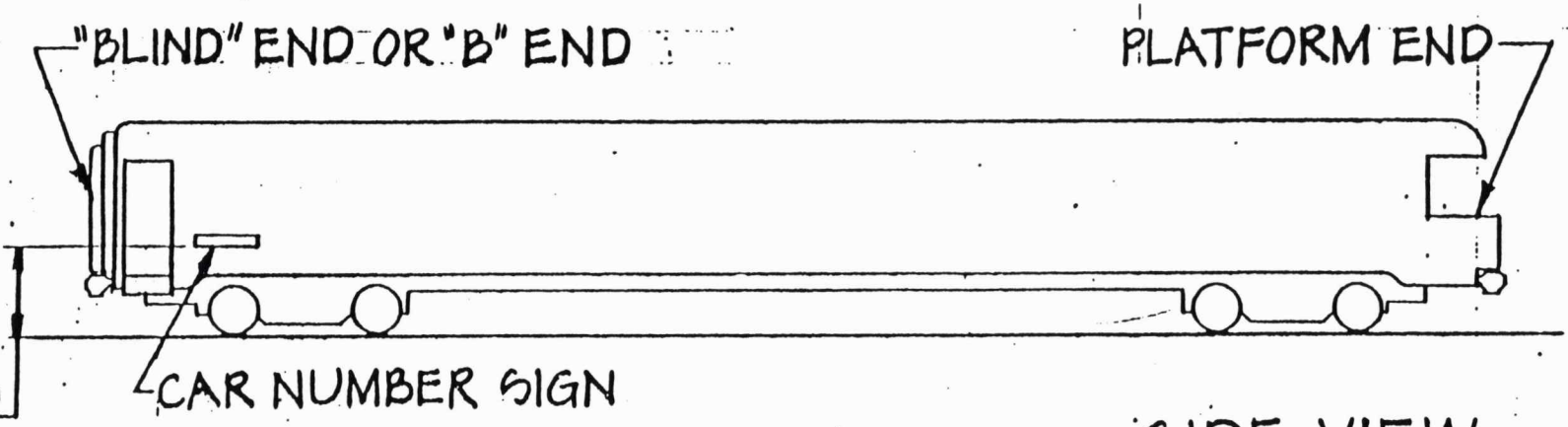
Amtrak-Chief Mechanical Officer
400 North Capitol Street, NW
Washington, DC 20001







SIDE VIEW
TYPE I CAR



SIDE VIEW
TYPE II CAR

NOTE:

- CAR NUMBER TO BE OF THE 800000 SERIES
- NUMERALS TO BE 2" HIGH (REF. DRW'G. D-002-3042, ITEMS-97 THRU-106)
- LOCATE SIGN AS INDICATED

TITLE: CAR NUMBER SIGN — PRIVATE CARS

EQUIPMENT ENGINEERING
Amtrak (N.R.P.C.)
400 N. Capitol St., Washington, D.C. 20001

REV | A | B

SECTION II

APPLICATION OF ELECTRIC MARKER LIGHTS F.R.A. APPROVED

AMTRAK

SPECIFICATION #D-77-27

COVERING APPLICATION
OF ELECTRIC MARKER LIGHTS
FRA APPROVED

APPROVED BY	DATE
A.V. Erlandson	5/10/78
L.R. Bent	5/10/78
R.D. Huggenbothem	5/11/78

Rev. A 4/19/78

1. Scope

This specification covers the application of incandescent electric marker lights on Amtrak Conventional Railroad passenger cars, to meet the Federal Railroad Authorization Act of 1976, Public Law 94-348. Amfleet and Superliner cars meet the requirements.

2. Description

This unit is to be used on the rear end of a train as a highly visible marking device.

3. Requirements

Marker device is required to have the following minimum requirements:

(a) Marker device to have an intensity of not less than 100 candela nor more than 1,000 candela as measured at the center of the beam in accordance with Section 4.

(b) A horizontal beam with a minimum arch width of fifteen (15) degrees each side of the vertical center line, and a vertical beam with a minimum arc width of five (5) degrees each side of the horizontal center line as defined in terms of the 50 candela intensity points.

(c) A color defined by the red-orange-amber color range those colors defined by chromaticity coordinates, as expressed in terms of the International Commission on Illumination's 1931 Colormetric System, which lie within the region bounded by the spectrum locus and lines defined by the following equations:

$$x + y = .97 \quad \text{(white boundary)}$$
$$y = x - .12 \quad \text{(green boundary)}$$

(d) Minimum 5 inch diameter lens.

(e) Minimum power requirement (watts)

Color	Power
red or red-orange	20
yellow or orange	10

4. Minimum Test Requirements

(a) The intensity measurements shall be made with the device mounted in its normal operating position at a distance of 25 feet from the device. Measurements shall be made under dark conditions.

(b) Intensity (of effective intensity) measurements shall be made at points A, B, C, D, E, F, G, H and I as specified in Table 1.

TABLE 1 - Test Points

Test Point	Distance from Device (ft.)	Location (deg.) Vertical	Horizontal
A	25	0	-15
B	25	0	-10
C	25	0	- 5
D	25	0	0
E	25	0	+ 5
F	25	0	+10
G	25	0	+15
H	25	-5	0
I	25	+5	0

(c) Intensity shall be at least 100 and not more than 1000 candella at point D and a minimum of 50 candella at points A, B, C, E, F, G, H and I. Table 2 shows the relationship between candella and foot candles at 25 feet from the light source for a steady burning light.

TABLE 2 - Candella - Foot Candle Relationship at 25 feet from Source

Candella	Foot Candles
50	.08
100	.16
200	.32
300	.48
400	.64
500	.80
1000	1.60

5. Amtrak Approved Lamps and Fixtures

a) Lamp GE 60 PAR/2/R 60 Watt, 38 volt, PAR 46 or equal.

b) Fixtures
Translite #FC-3895 (Re-lamp from inside of car)
Luminator #0101890-001 (Re-lamp from outside of car)

See DWG D-00-1312 For Approved List

Fixtures are of different design and should be selected according to car construction etc. Both fixtures accept the GE 60 PAR/2/R Lamp.

6. Application

Existing marker lights that do not meet FRA requirements are to be replaced.

On cars not presently equipped with approved marker lights, AMTRAK approved marker lights are to be installed at an area approximately 120" from the top of rail and approximately 45" from each side of the centerline of the car. (Two lights at each car end)

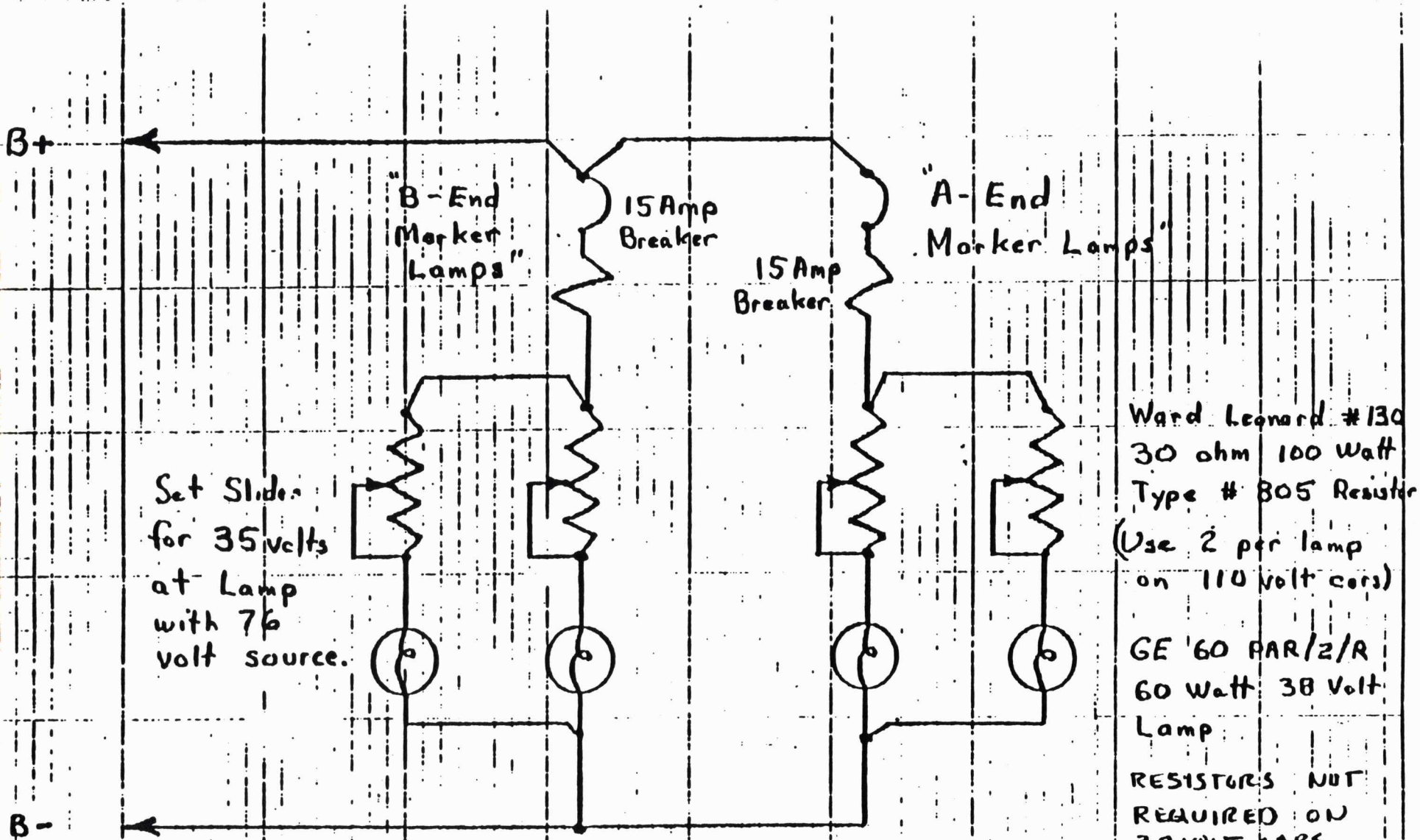
A separate switch to control each end of car is to be provided.

A voltage dropping resistor is required for each lamp on 32, 64 and 110 volt systems. The resistors are to be adjusted to provide 35 volts at the lamps when the battery charging system is normally operating.

Resistor to be ward Leonard type 130, 30 ohm, 100 Watt, Type #805 with adjustable slide #604 (or equivalent) (2 resistors per bracket, 2 brackets per car, to be used on 64 volt system)

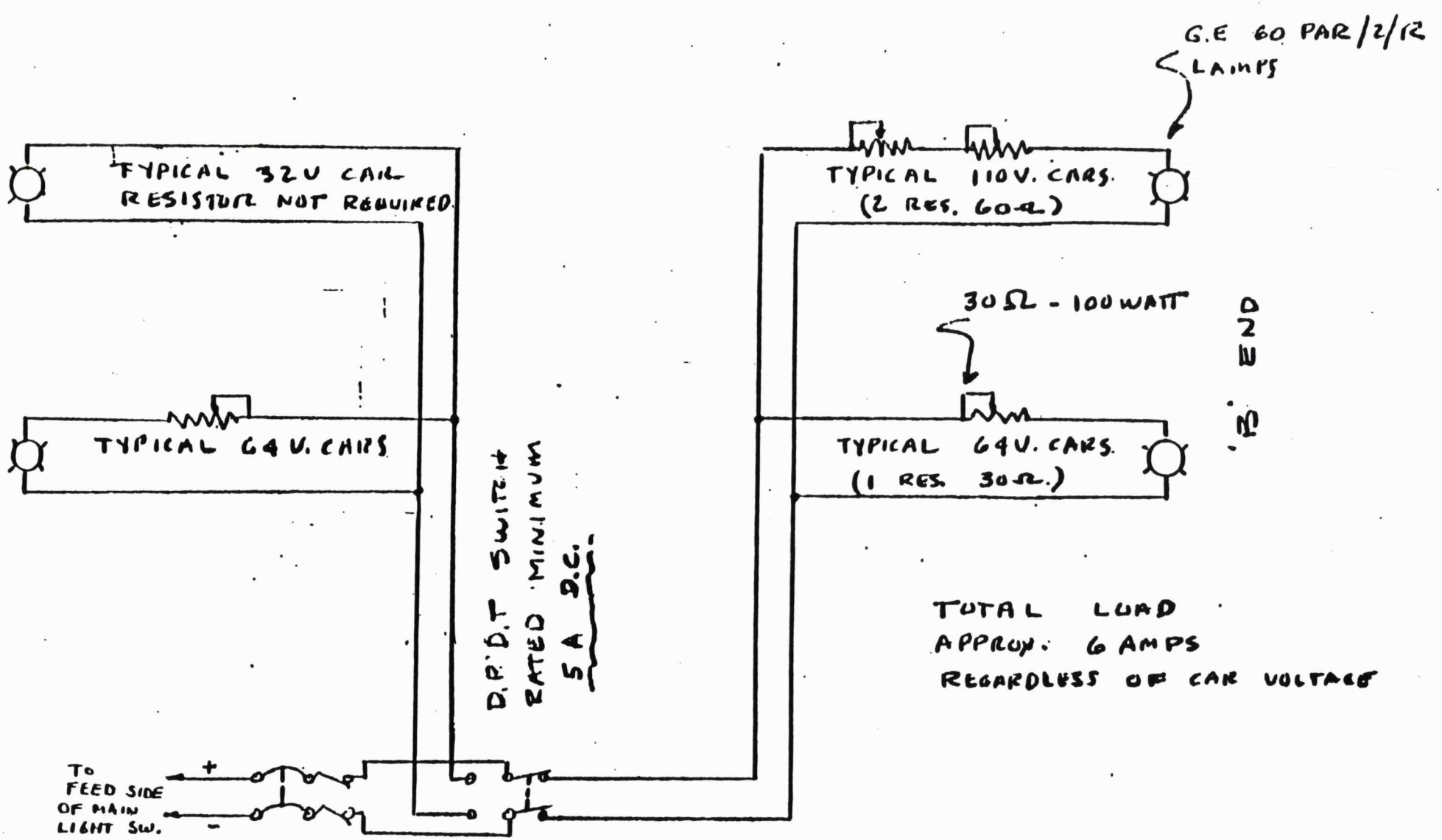
On 110 volt cars the use of 2 of the above resistors connected in series for each marker light is required.

Cars to be selected for this modification must have the authorization of the Chief Mechanical Officer.



SK-A-120177

TYPICAL MARKER LIGHT WIRING



TOTAL LOAD
APPROX. 6 AMPS
REGARDLESS OF CAR VOLTAGE

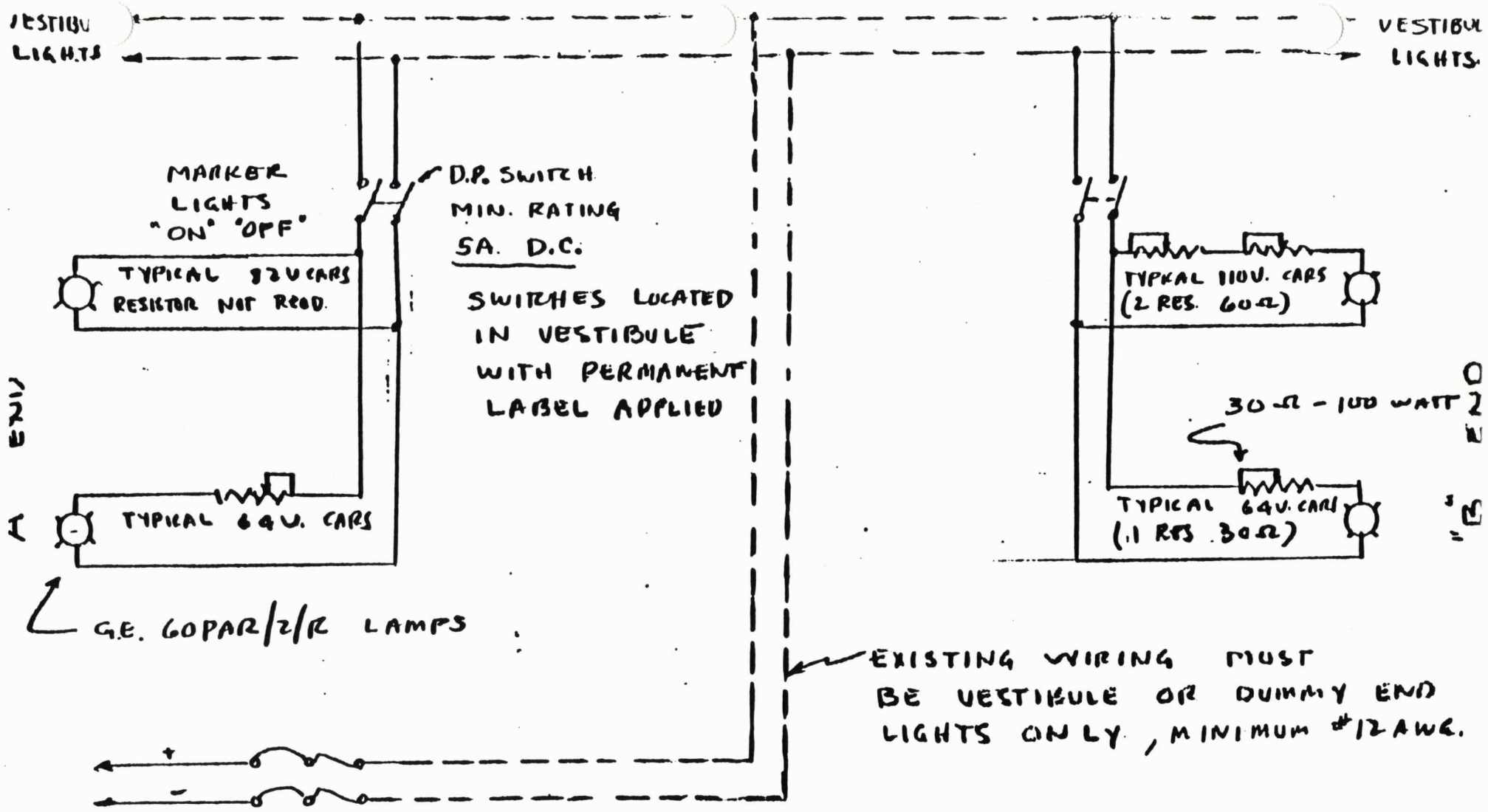
NOTE

LOCATE C.B IN ELECTIC LOCKER ADD D.P.D.T. SWITCH IN VESTIBULE APPLY PERMANENT TYPE LABELS.

SK-A-120177-1

MARKER LIGHT WIRING. (ALTERNATE METHOD 1)

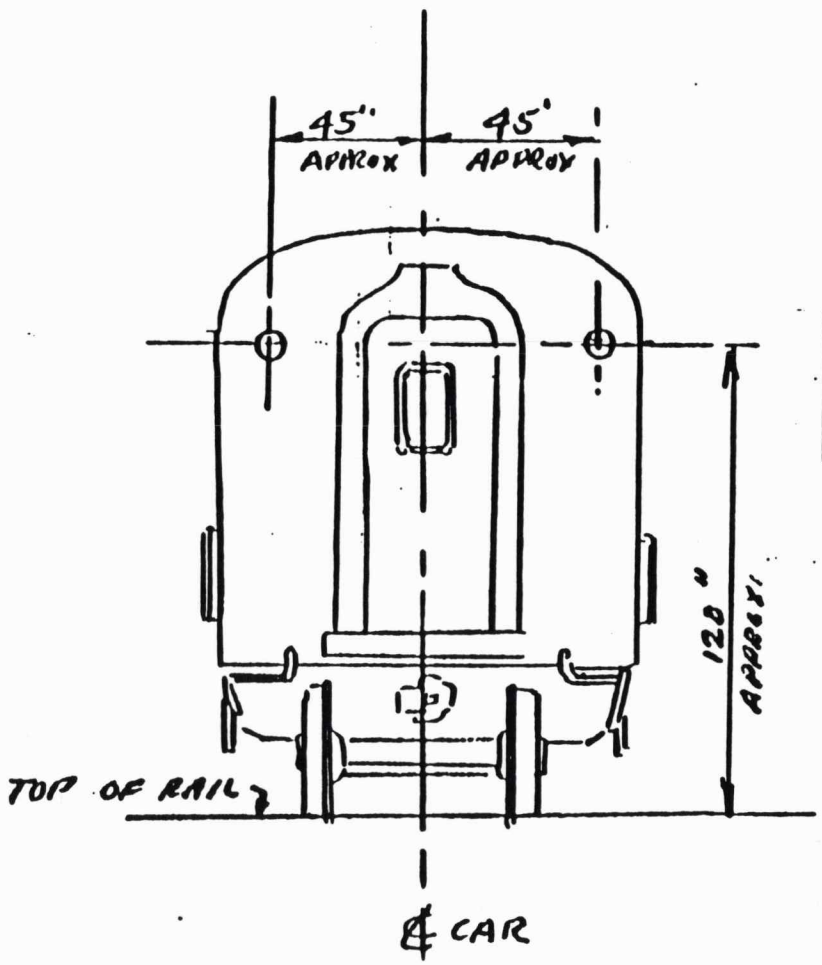
REFER SPEC #D-[illegible]7



SK-A-120177-2

MARKER LIGHT WIRING.
(ALTERNATE METHOD)

REFER SPEC # D-77-27



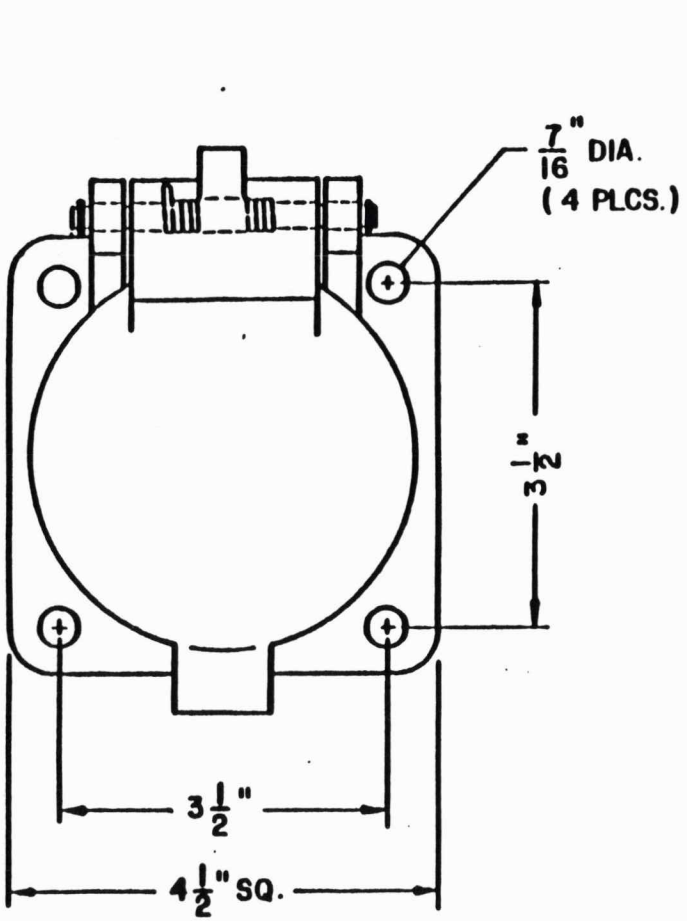
NOTES

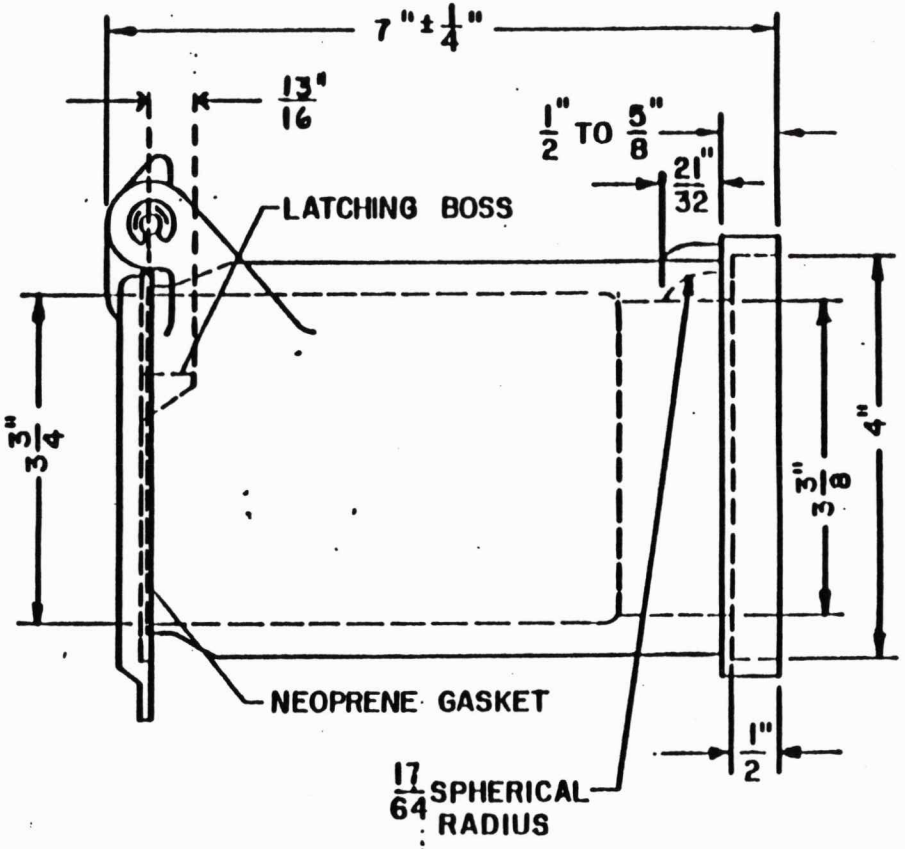
1. REFER TO AMTRAK SPECIFICATION "D-77
2. REPLACE MARKER LIGHTS THAT DO NOT HAVE A GE LAMP # 60 PAR/38/2
3. FRA APPROVED MARKER LIGHTS ARE
   (A) TRANSLITE #FM-3995-1 - (RE-LAMP INSIDE)
   (B) LUMINATOR #0101890-001 (RE-LAMP OUTSIDE)
   SELECT MARKER FIXTURE ACCORDING TO CAR CONSTRUCTION. LUMINATOR PREFER FOR HIGH LEVEL CARS.
4. FOR WIRING REFER TO SK-A-120177
5. LOCATE NEW MARKER LIGHTS IN EXISTING LOCATION. IF CAR DOES NOT HAVE MARKERS LOCATE AS SHOWN ON THIS SKETCH. THESE DIMENSIONS ARE APPROXIMATE AND CAN BE VARIED BECAUSE OF CAR CONSTRUCTION ETC.
   THE 45" DIMENSION MAX. 55" MIN. 40"
   THE 120" DIMENSION MAX 130" MIN. 100"
   MARKER LIGHTS TO BE SYMETRIC
6. GENERAL NOTES
   (A) PREFER FLUSH MOUNTING.
   (B) EXTERIOR BOX ACCEPTABLE IF CAR CONSTRUCTION DOES NOT PERMIT FLUSH MOUNTING.

SK-A-050378 R
MARKER LIGHT APPLICATION
FRA APPROVED

SECTION III

SPECIFICATION 480V RECEPTACLES, JUMPERS



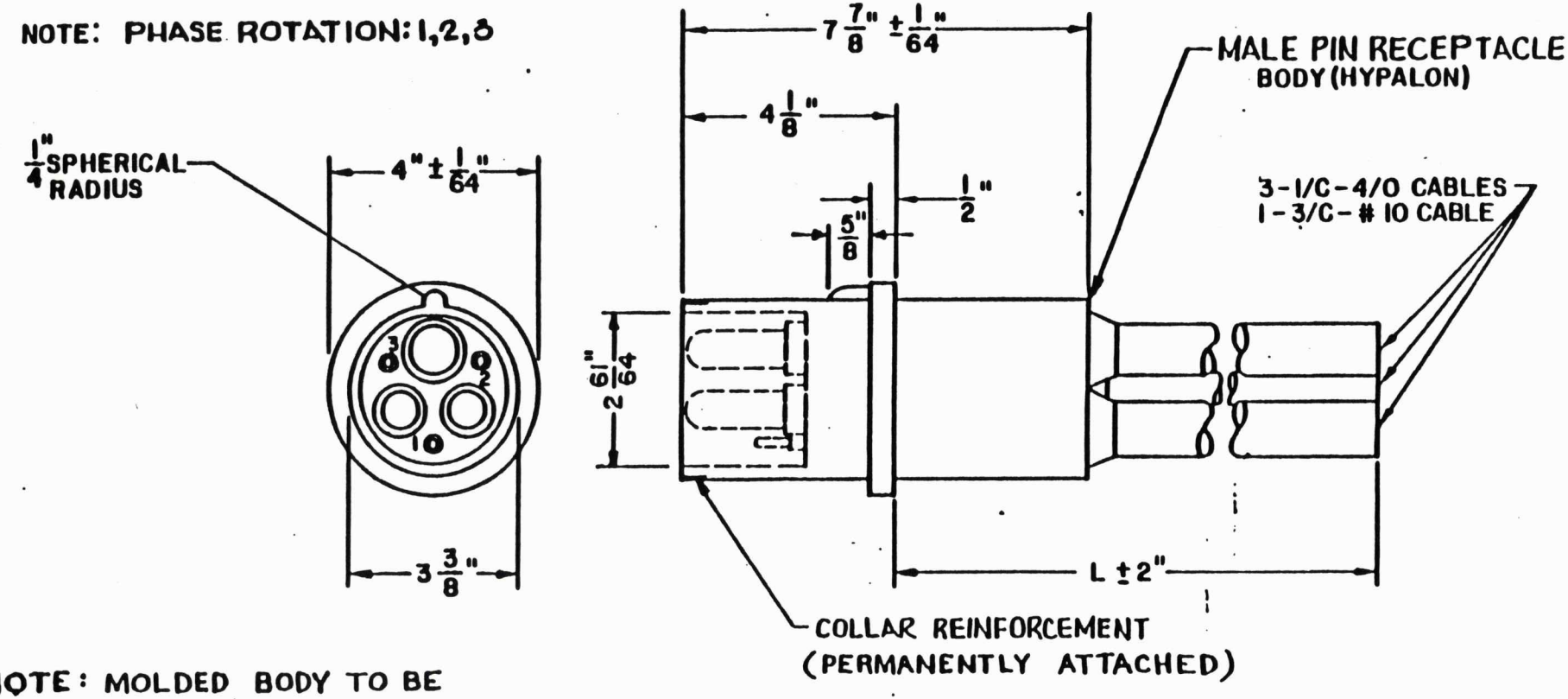


NOTE: 1. HOUSING TO BE PAINTED
AMTRAK RED (SW F-42-R-C20)
2. AMTRAK PART NO. 25A4000080

FIGURE 1
480 VOLT - 400 AMP
OUTLET HOUSING

REV. B

NOTE: PHASE ROTATION: 1,2,3



NOTE: MOLDED BODY TO BE RED IN COLOR

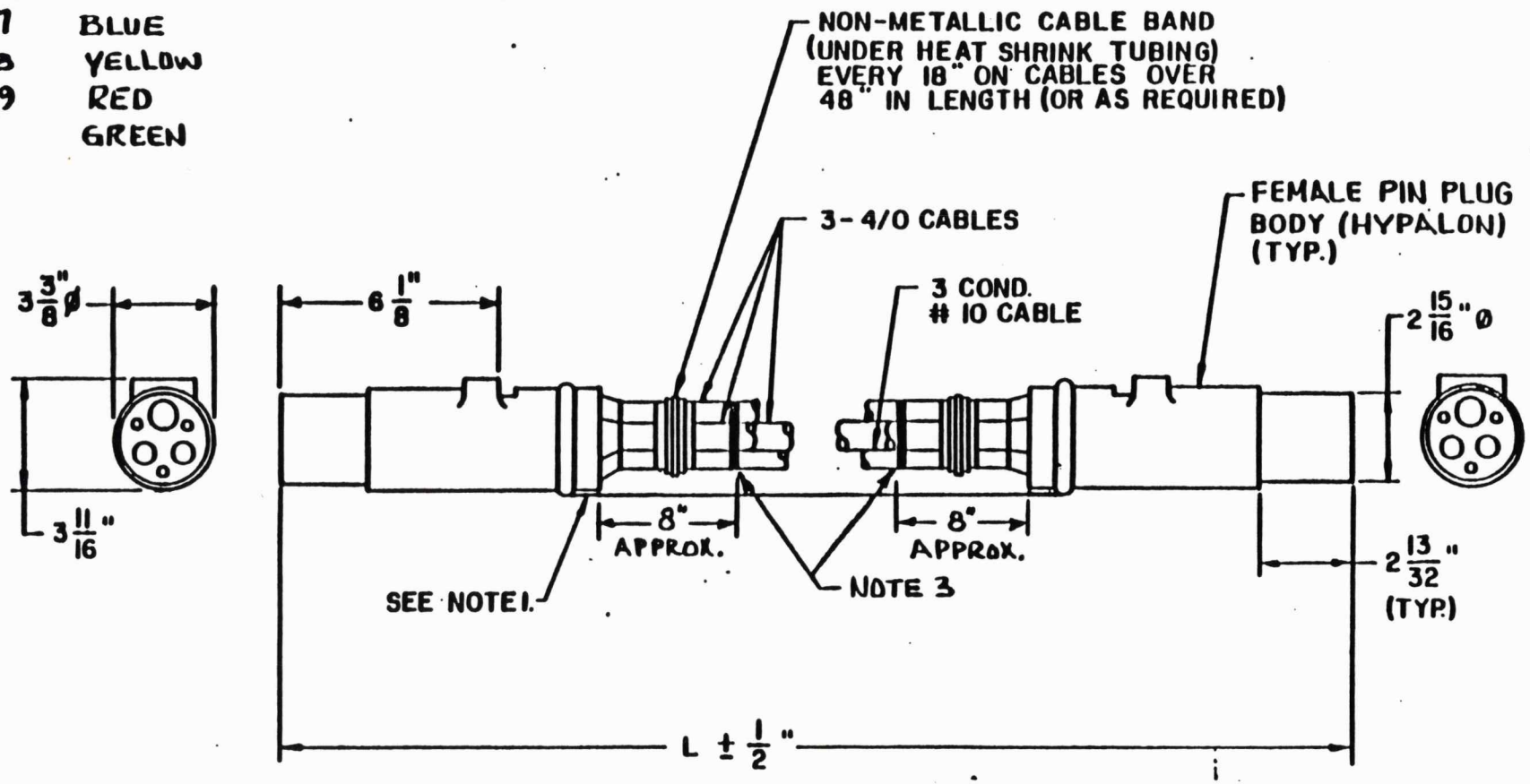
DIM. L	AMTRAK PART NO.	REFERENCE
24"	25A4000082	
36"		
48"	25T5000001	

FIGURE 2

480 VOLT - 400 AMP
OUTLET CABLE ASSEMBLY

REV. B - 80
REV. C 8-81

YEAR ENDING IN	COLOR
1,4,7	BLUE
2,5,8	YELLOW
3,6,9	RED
0	GREEN



NOTE: 1. WHEN SPECIFIED;
PLASTIC COATED STRAIN RELIEF WIRE OR CHAIN IS TO PROVIDE SLACK IN CABLE.
2. MOLDED BODIES ARE TO BE RED IN COLOR.
3. MINIMUM OF THREE WRAPS 1½" WIDE PVC TAPE COLORED (OSHA COLORS) AS SHOWN ABOVE

DIM. L	AMTRAK PART NO.	REFERENCE
51"	25A4000083	CAR TO CAR
84"	25A4000081	LOCO TO CAR
26'	25A4000186	STDBY TO CAR
50'	25X9010245	STDBY TO CAR
100'	25A4000269	STDBY TO CAR

FIGURE 4

480 VOLT - 400 AMP PORTABLE JUMPER CABLE ASSEMBLY

9-6-1977

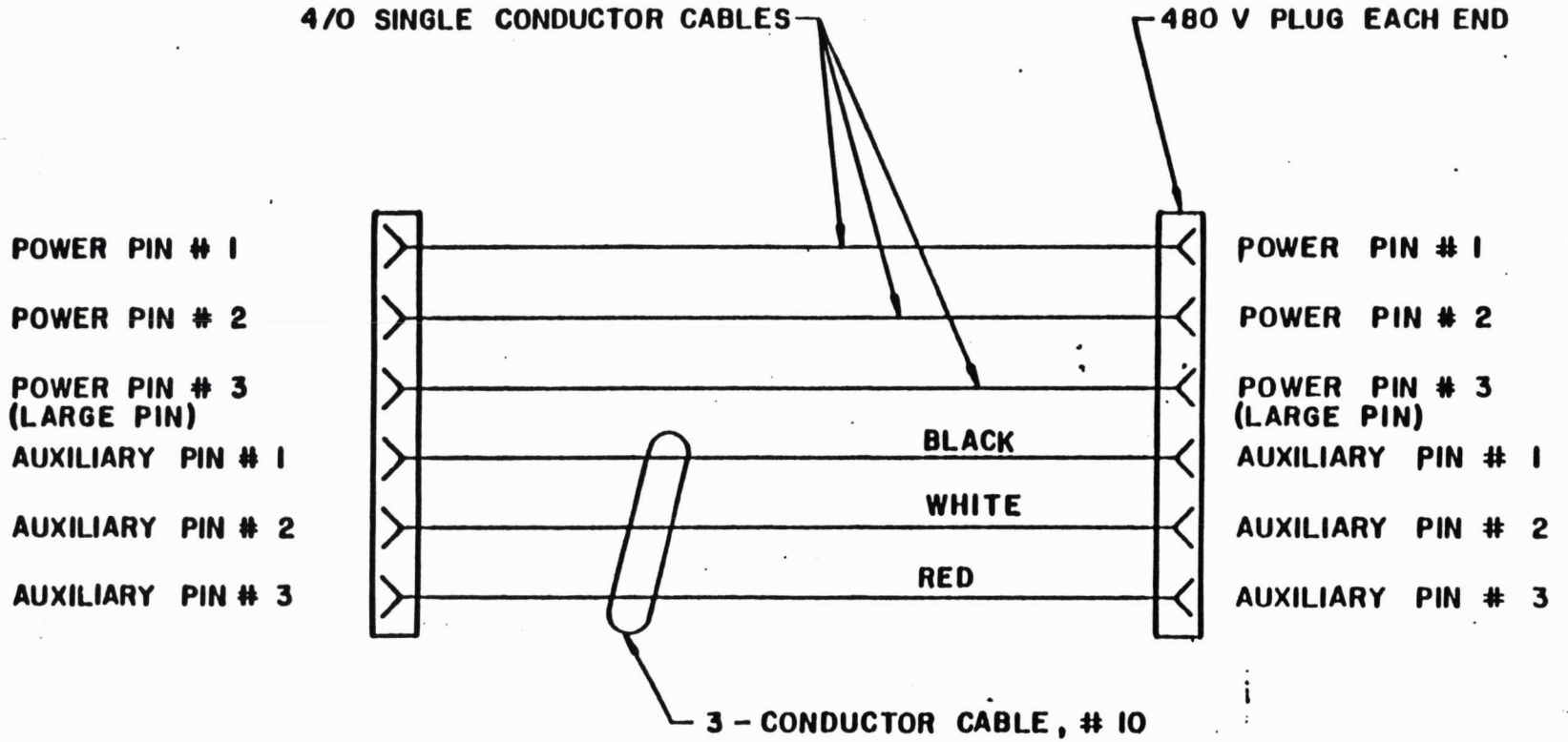
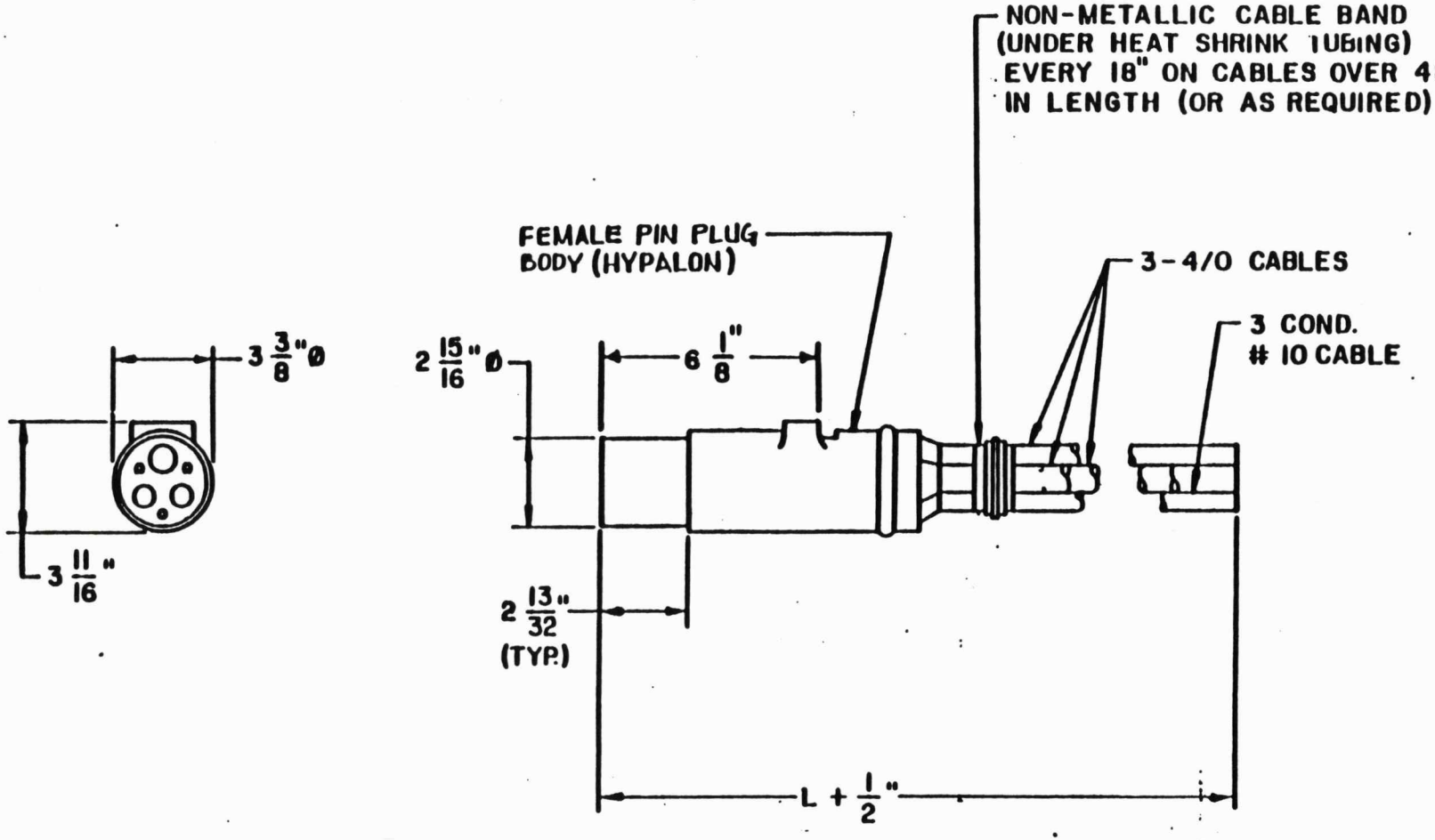


FIGURE 5

JUMPER CABLE ASSEMBLY WIRING SCHEMATIC

REV. B



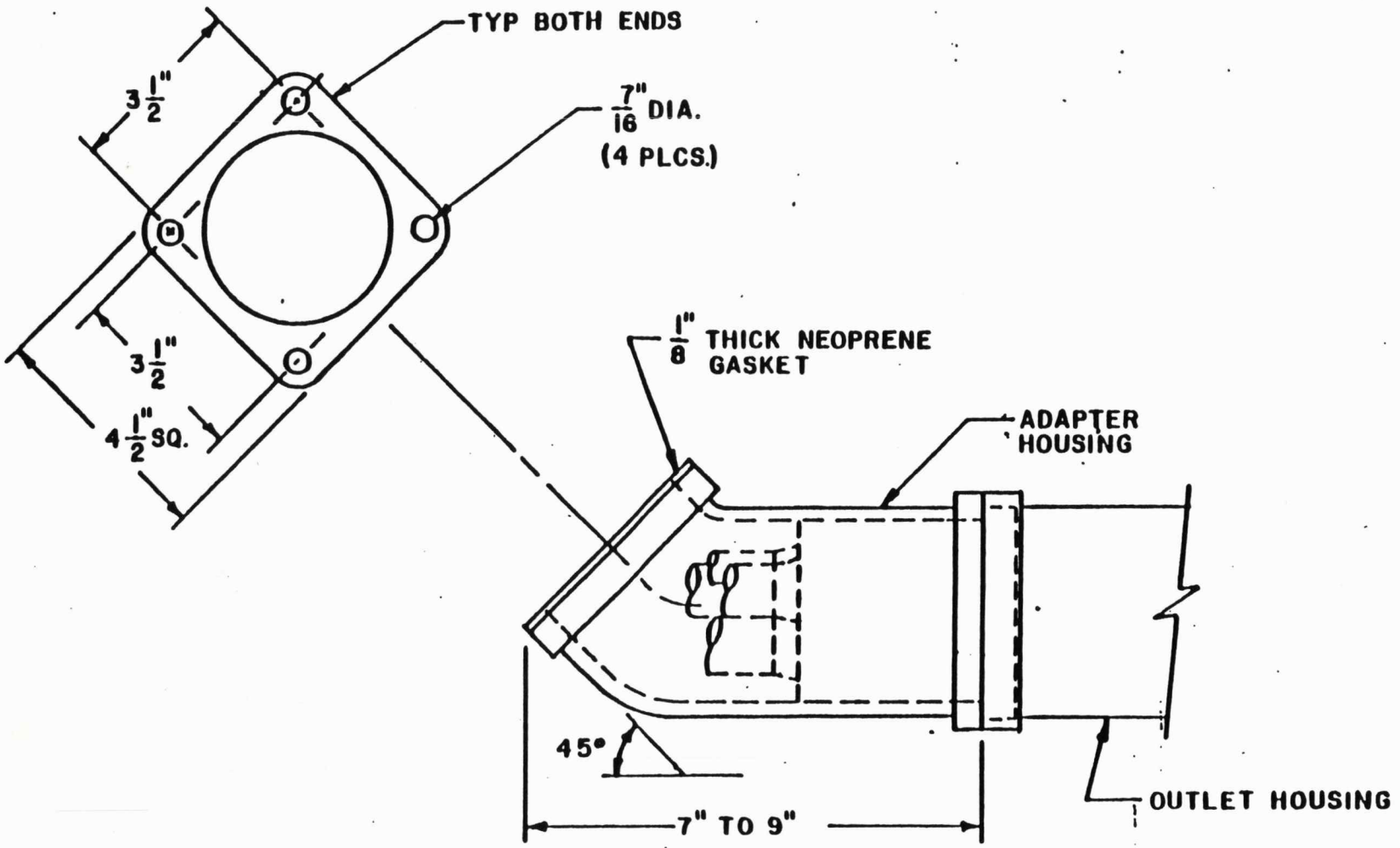
NOTE: MOLDED BODY TO BE RED IN COLOR.

M.L	AMTRAK PART NO.	REFERENCE
1.5"	25N5000002	

FIGURE 6

480 VOLT – 400 AMP

FIXED JUMPER CABLE ASSEMBLY

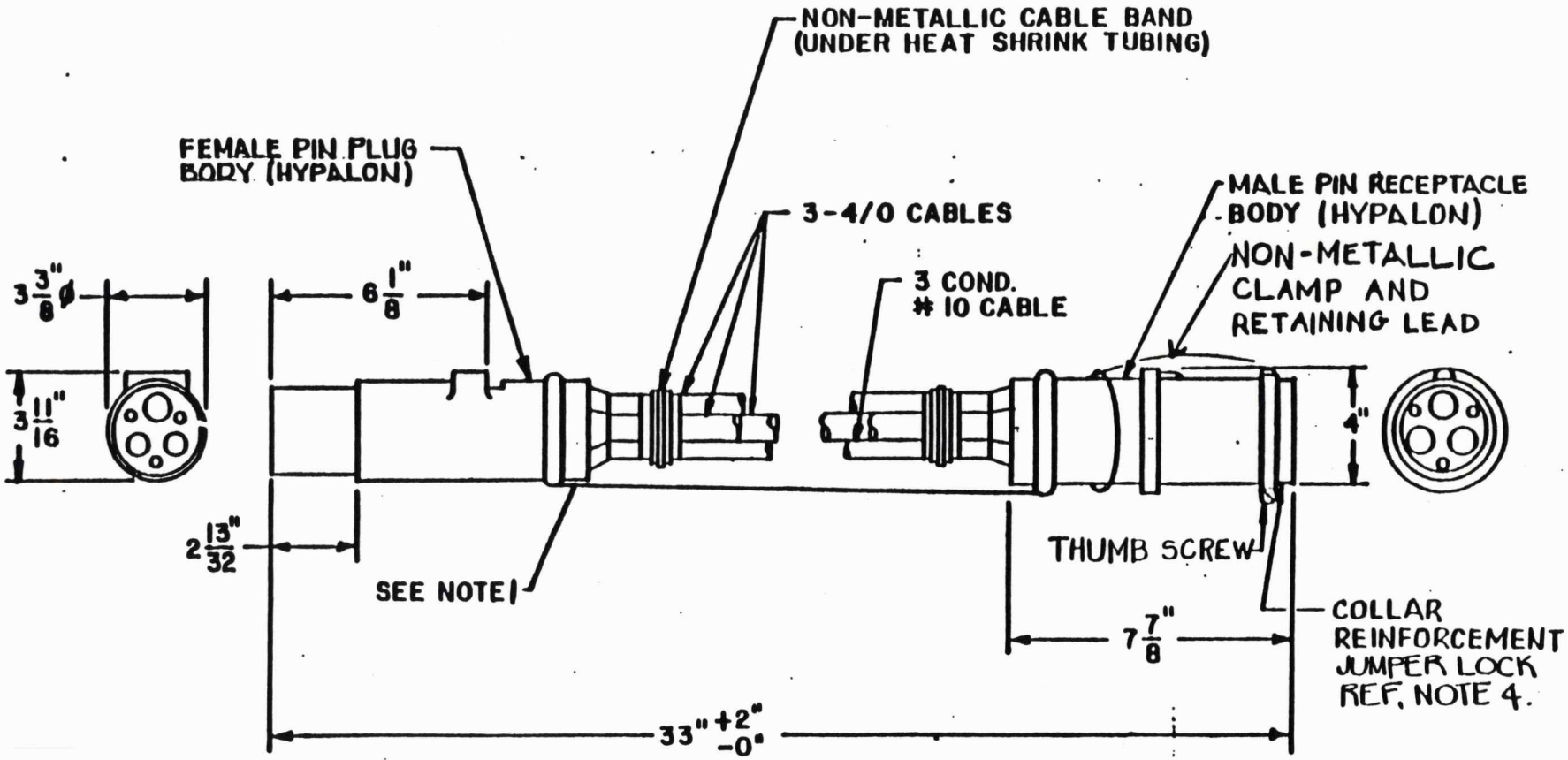


NOTE: 1. HOUSING TO BE PAINTED AMTRAK RED (SWF-42-R-C20)
2. AMTRAK PART NO.

FIGURE 7

480 VOLT - 400 AMP
OFFSET ADAPTER

6-27-1980

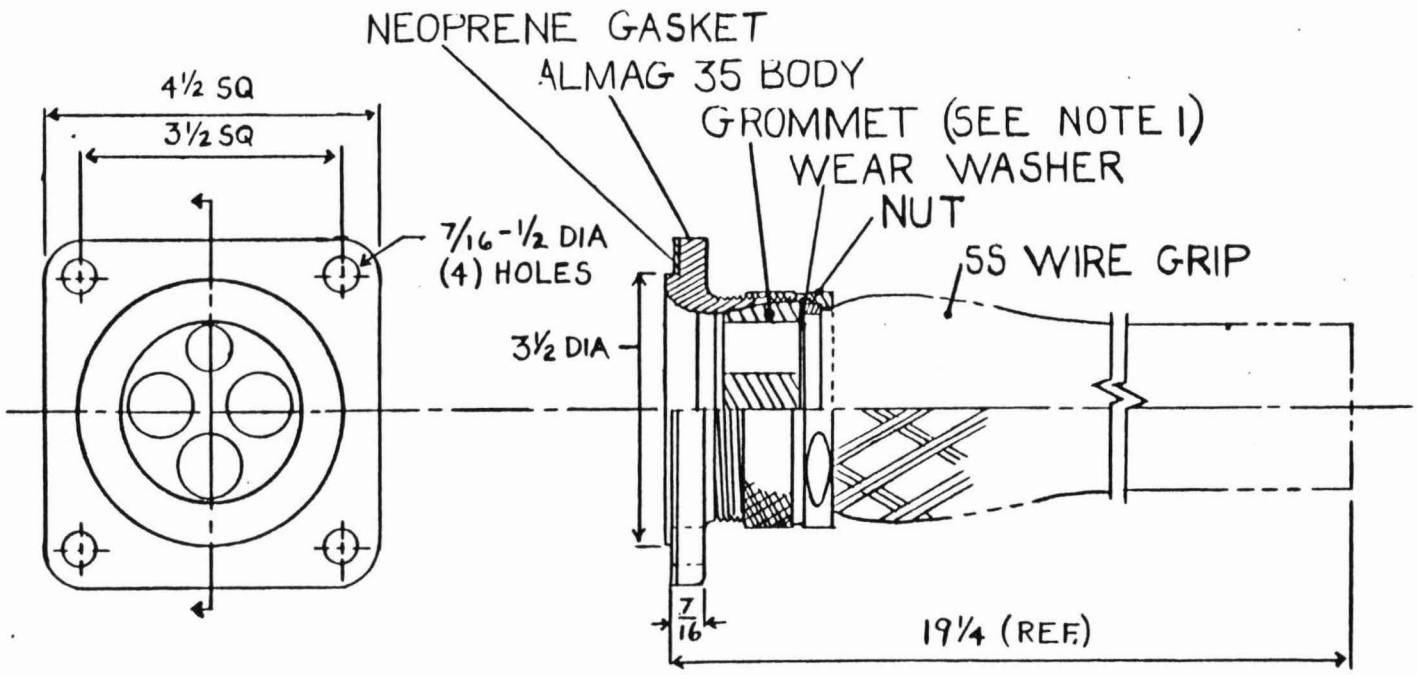


NOTE:

1. WHEN SPECIFIED:
   THE PLASTIC COATED STRAIN RELIEF WIRE OR CHAIN IS TO PROVIDE SLACK IN CABLE.
2. MOLDED BODIES ARE TO BE RED IN COLOR.
3. AMTRAK PART NO., 25E6001105.

FIGURE 8

480 VOLT – 400 AMP
ADAPTER JUMPER CABLE ASSEMBLY



NOTES: 1. WHEN INSTALLED, THE GROMMET MUST FORM A WATERTIGHT SEAL BETWEEN ITSELF AND THE BODY AS WELL AS ITSELF AND THE CABLES UTILIZED IN THE ASSEMBLIES SPECIFIED IN PARAGRAPH III. B.3. (FIGURE 6)

FIG. 9 FIXED JUMPER CABLE GRIP / ADAPTER

SECTION IV

SPECIFICATION WIRE

4/0 TRAINLINE CABLE FOR UNDERCAR USE

Selecting electrical wire for a given application is a more complex task than may be immediately apparent. Among items specified include conductor properties, tinning, stranding, strand bundling, insulation materials, temperature rating, thicknesses, number of layers, separators, etc. These and other properties determine how well a cable will perform in the particular application.

The 4/0 cable used for the 480 volt undercar trainline system is subjected to a demanding environment, which calls for stringent wire and insulation specifications. For private car use, Amtrak approves the use of the following materials:

MATERIAL	TEMP. RATING	specIFICATION	MANUFACTURER	TRADE NAME
Cross-linked Polyolefin (XPLE)	110°C	Amtrak Q-78-7	SURPRENANT	EXANE
Cross-linked Polyolefin (XPLE)	110°C	Amtrak Q-78-7	CHAMPLAIN	EXAR
Hypalon	90°C	AAR-589	VARIOUS	--

Exane and Exar are now standard for undercar trainline wire on Amtrak equipment. This material has superior abrasion resistance to Hypalon, as well as a considerably higher temperature rating. Private car owners who expect to run considerable mileage are advised to use XPLE material rather than Hypalon as it has a greater life expectancy on the road, especially under heavy electrical load conditions. Hypalon is a family of insulating compounds, with varying properties, rather than an specific product. For this reason, if Hypalon insulation is selected, care must be taken to ensure it conforms to AAR spec #589. This specification defines not only the properties of the insulation and its dimensions, but also the copper conductor. "Diesel Locomotive" cable is not necessarily per the AAR spec, and could be very inadequate for railcar service in areas such as insulation thickness, temperature rating, etc.

4/0 TRAINLINE CABLE FOR UNDERCAR USE

Selecting electrical wire for a given application is a more complex task than may be immediately apparent. Among items specified include conductor properties, tinning, stranding, strand bundling, insulation materials, temperature rating, thicknesses, number of layers, separators, etc. These and other properties determine how well a cable will perform in the particular application.

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Hypalon	90°C	AAR-589	VARIOUS	--

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AMTRAK

SPECIFICATION

FOR

HIGH PERFORMANCE WIRE AND CABLE

SPECIFICATION #Q-78-7

MAY 9, 1978

NATIONAL RAILROAD PASSENGER CORPORATION

REVISION	APPROVED	DATE
A	LRB	2/13/79
B	LRB	7/11/79

Approved By	Date
L R Beth	5/10/78
L.D. Higginbotham	5/10/78
E J Engelhardt	5/15/78
[illegible]	5/25/78

RELEASED BY:	Initials	Date
EQUIPMENT ENGINEERING	LRB	5/25/78
PROCUREMENT	[illegible]	[illegible]

1.0 SCOPE

This document describes the physical and electrical properties for 110°C rated wire and cable used on Amtrak Rolling Stock.

2.0 GENERAL

All wire and cable procured under this specification must exhibit the properties outlined in the specification and must either be on Amtrak's approved source list, (paragraph 7.0) or must be approved, in writing, by Amtrak Equipment Engineering Department.

3.0 WIRE CONSTRUCTION

Conductor: Soft Annealed Copper
Coating: Tin
Stranding: Per AAR 589 (See parapgraph 5.0)
Insulation: Crosslinked Polyolefin

4.0 PROPERTIES

4.1 APPLICABLE DOCUMENTS

The wire and cable manufactured under this specification shall be tested and inspected in accordance with the latest issues of the following standards, as applicable or as modified herein:

ASTM B-33 - Tinned Soft or Annealed Copper Wire

ASTM D-149 - Test for Dielectric Breakdown Voltage & Dielectric Strength of Electrical Insulating Materials at Commercial Power Frequencies

IPCEA S-19-81 - Rubber Insulated Wire & Cable

IPCEA S-66-524 - Cross-Linked-Thermosetting-Polyethylene Insulated Wire & Cable for the Transmission & Distribution of Electrical Energy

UL 44 - Standard for Rubber Insulated Wire & Cable

IEEE Std. 383-1974 - Type Test of Class 1E Electrical Cable, Field Splices & Connectors for Nuclear Power Generating Stations

4.2 ELECTRICAL

Dielectric Strength per ASTM D-145	700V/Mil Minimum
Insulation Resistance	5000 megohms Minimum
Insulation Resistance K	17,500 Minimum
Accelerated Water Absorption	
Gravimetric 7 days @ 70°C	8MG/in² Maximum
Electrical SIC 24 hours @ 75°C	6.0 Maximum
Increase in Capacitance	
1-14 Days (% of Original)	7.5 Maximum
7-14 Days (% of Original)	1.5 Maximum
Stability Factor after 14 days	1.0

4.3 PHYSICAL

Unaged	
Tensile Strength, Min. PSI	2000 Minimum
Elongation at Rupture, Min. %	250 Minimum
Aged	
After air oven 7 days @ 158°C ± 2°C	
Tensile Strength (% of original)	90 Minimum
Elongation (% of original)	55 Minimum
Heat Distortion, 1 hour @ 200°C Clause 4.3.6.1 CSA Std. C22.2 No. 0.3	20% Maximum
Cold Bend, 120 hours @-55°C	* 6KV-5 Minutes
Cold Bend, 2 inch Mandrel - 85°F (per Paragraph 4.7.4.15 MIL-C-22759)	* Pass

4.4 QUALIFICATION

Tension Set: Test per IPCEA-S-66-524, Paragraph 6.4.11.4 (Except with gauge marks 4" apart). Requirement: 30% Maximum

Ozone Resistance: After 24 hours exposure to an ozone concentration of 0.03% by volume at 90°C ± 2%, there shall be no insulation cracks.

Flammability Requirements: Insulated conductors shall pass the flame tests described in Paragraph 6.19.6 of IPCEA S-19-81 and the VW-1 vertical flame test described in UL Subject 44. The maximum afterburn after each flame application shall be no greater than 3 seconds.

* Must Not Exhibit Cracking

4.4 Qualification (continued)

Corrosion Tests:

A. Copper Mirror. (Ref. ASTM 2671) A 0.4 gram sample of insulation shall be placed in the bottom of a 1/2 inch x 12 inch test tube. A copper coated glass mirror shall be suspended 6 inches over the sample by a thin copper wire. The lower two inches of the test tube shall be heated to 175°C for 16 hours. Requirements: Shall not remove more than 5% of the copper film.

B. Acid Gas Detection. A 1.0 mg sample shall be heated to combustion in a closed quartz tube. The resulting gases shall be drawn through a detector tube (MSA #91636) using a special air sampling pump manufactured by Mine Safety Apparatus Company. The amount of acid gas shall be determined by measuring the length of the color change in the detector tube. Requirement: 300 PPM/MG maximum average. (350 PPM/MG maximum any single sample) A

Oil Resistance: Hot Oil Swell Tests - Insulated wires shall be premeasured and immersed in a hot oil bath. After the required exposure time, they shall be removed and measured for the amount of swell.

Requirement:

A. ASTM No. 1-Oil 100 hours @150°C Max. % Swell 20
B. ASTM No. 2-Oil 100 hours @150°C Max. % Swell 40
C. ASTM No. 3-Oil 100 hours @150°C Max. % Swell 50
D. Diesel Oil 120 hours @ 60°C Max. % Swell 15

NOTE: When tested in accordance with AAR589 (ASTM #2 oil at 121°C for 18 hours) the retention of tensile and elongation shall be: Tensile - 70% Minimum, Elongation - 90% Minimum.

Smoke Emission: The test shall be performed in an N.B.S. Smoke Chamber using #12 AWG wire insulated with 45 mils of insulation. The procedures shall be per NFPA Standard 258 in the flaming (F) and non-flaming (N) modes.

	Dm	T16	T.9DM
(F) Flaming plus Radiant Furnace	447	1.05	7.15
(N) Non-Flaming Radiant Furnace	199	11.6	27.1

Dm = Max. Specified Optical Density

T16 = Time to reach critical Ds (Specified Optical Density)

T.9DM = Time to reach 90% of Dm

4.4 Qualification (continued)

Abrasion Resistance: Rotating Scrap Abrader (Ref. MIL-C-915). A 24 inch specimen shall be draped over an 8 inch rotating drum with two (2) 90° vee edge abrading tools 180° apart. Failure shall be detected by electrical contact between abrading tool and conductor. The cable shall be weighted with a 450 gram mass. Requirement: 2500 cycles minimum.

Cut-Through Penetration: Specimen of insulated wire shall be preconditioned at 125°C for 1 hour. While at this temperature, a weighted (1000 gm) 90°C chisel cutting edge shall be applied perpendicular to the longitudinal axis of the specimen. Detection of cut-through shall be monitored wit a 12 volt lamp circuit connected in series with the plunger and conductor in the specimen. Requirement: 10 minutes minimum.

Crush Resistance: A wire sample shall be placed between two (2) parallel flat plates and compressed until electrical contact is detected across conductor to the plate. Requirement: 7500 lbs. minimum.

APPROX. AREA (CM)	APPROX. SIZE AWG	NO. & SIZE EACH WIRE IN STRAND	TYPE OF STRANDING	CONDUCTOR DIAMETER (INCHES)	INSULATION THICKNESS (MILS) 600V	2000V	MAXIMUM CABLE DIAMETER (INCHES) 600V	2000V
1900	18	19/30	Conc.	.052	30	45	.120	.150
2601	16	19/.0117	Conc.	.060	30	45	.130	.160
3831	14	19/27	Conc.	.070	30	45	.145	.175
6088	12	19/25	Conc.	.090	30	45	.165	.195
10910	10	27/24	Bunch	.123	30	45	.200	.230
14950	8	37/24	Conc.	.140	45	55	.250	.270
24640	6	61/24	Conc.	.180	45	55	.310	.330
36760	5	91/24	Rope	.220	45	55	.345	.365
42420	4	105/24	Rope	.240	45	55	.365	.385
50500	3	125/24	Rope	.260	45	55	.390	.410
60600	2	150/24	Rope	.325	45	55	.430	.450
90900	1	225/24	Rope	.390	55	65	.515	.535
111100	1/0	275/24	Rope	.420	55	65	.565	.585
131300	2/0	325/24	Rope	.460	55	65	.605	.630
181800	3/0	450/24	Rope	.565	55	65	.695	.715
222200	4/0	550/24	Rope	.590	55	65	.750	.770
262600		650/24	Rope	.660	65	75	.810	.835
313100		775/24	Rope	.740	65	75	.880	.900
373700		925/24	Rope	.790	65	75	.960	.980
444400		1100/24	Rope	.870	65	75	1.025	1.045
535300		1325/24	Rope	.970	80	90	1.155	1.175
646400		1600/24	Rope	1.060	80	90	1.245	1.265
777700		1925/24	Rope	1.120	80	90	1.325	1.345
929200		2300/24	Rope	1.230	80	90	1.435	1.455
1111000		2750/24	Rope	1.370	95	110	1.595	1.625

6.0 IDENTIFICATION

The surface of the cable shall be printed with the following information at intervals not greater than two feet: Manufacturer, Insulation Type, Conductor Size, and Voltage Rating.

7.0 APPROVED VENDORS

1. ITT Suprenant Exane per Specification DAA1068A
* 2. Brand Rex Polyrad XT per Specification #BR-780
3. Haveg Industries, Inc. 113-25-2 per Specification #2754 B

* NOT APPROVED FOR 4/0 UNDERCAR CABLE.

REV C 10/87

SECTION V

RECOMMENDED PARTS

1. WIRE
2. TERMINAL BLOCKS
3. ELECTRICAL LUGS

Figure 6.1
ELECTRICAL WIRE

ITEM	QTY	DESCRIPTION	MFG	MFG #	AMT #	AMTS #
1		16 AWG (.030) 600V EXANE	ITT	FXE1929U	25X9009094	
2		14 AWG (.030) 600V EXANE	SURPRENANT	FXE1927U	25H9009092	
3		12 AWG (.030) 600V EXANE	"EXANE"	FXE1925U	25D9009093	
4		10 AWG (.030) 600V EXANE	OR	FXE2724U	25L9009091	
5		8 AWG (.045) 600V EXANE		FXE3724U	25B9009085	
6		6 AWG (.045) 600V EXANE	EQUAL	FXE6124U	25P9009087	
7		4 AWG (.045) 600V EXANE		FXE10524U	25X9009086	
8		2 AWG (.045) 600V EXANE		FXE15024U	25L9009080	
9		1/0 AWG (.055) 600V EXANE	PER SPEC	FXE27524U	25P9009090	
10		2/0 AWG (.055) 600V EXANE		FXE32524U	25N9012029	
11		4/0 AWG (.055) 600V EXANE	0-78-7	FXE55024U	2[illegible]9009089	
12		12 AWG Coated Copper 19x25 600V Insrinsul 200°C Hi Temp (Floor Heat)			25A9005273	
13		10 AWG Copper 600V Silicone 180°C Hi Temp (Floor Heat)			25D9007621	
14		8 AWG Copper 600V Silicone 180°C Hi Temp (Floor Heat)			25T9011879	
15		16/2 AWG 600V Neoprene Jacket Type "SO" (Wheel Slide)	Alpha	1935	25P9011647	
16		16/2 AWG Type "SO" Extra Flex Unk (Eyeball Light Fixture)			49A9000259	
17		12/2 AWG Type "SO" 600V (Standby Recept)			25P9004942	
18		10/3 AWG Type SO Extra Flexible Spec 562.1			25X9006521	
19		3/3 AWG Type W 600V (Standby Recept)			25K9011528	
20		16/2 AWG Shielded Twisted Pair (Wheel Slide)	Beldon	8719	25T9011686	
21		16/2 AWG Shielded Twisted Pair (Wheel Slide)	Alpha	3241	25X9012294	
22		16/2 AWG 2 Cond. Twisted, One Black, One White "Exane" (PA Speakers)	ITT SURPRENANT		25H9011408	
23		14/2 AWG 2 Cond. Twisted and Shielded (Train Line)	ITT SURPRENANT		25X9011811	

FIGURE 6.2
1492 SERIES TERMINAL BLOCKS

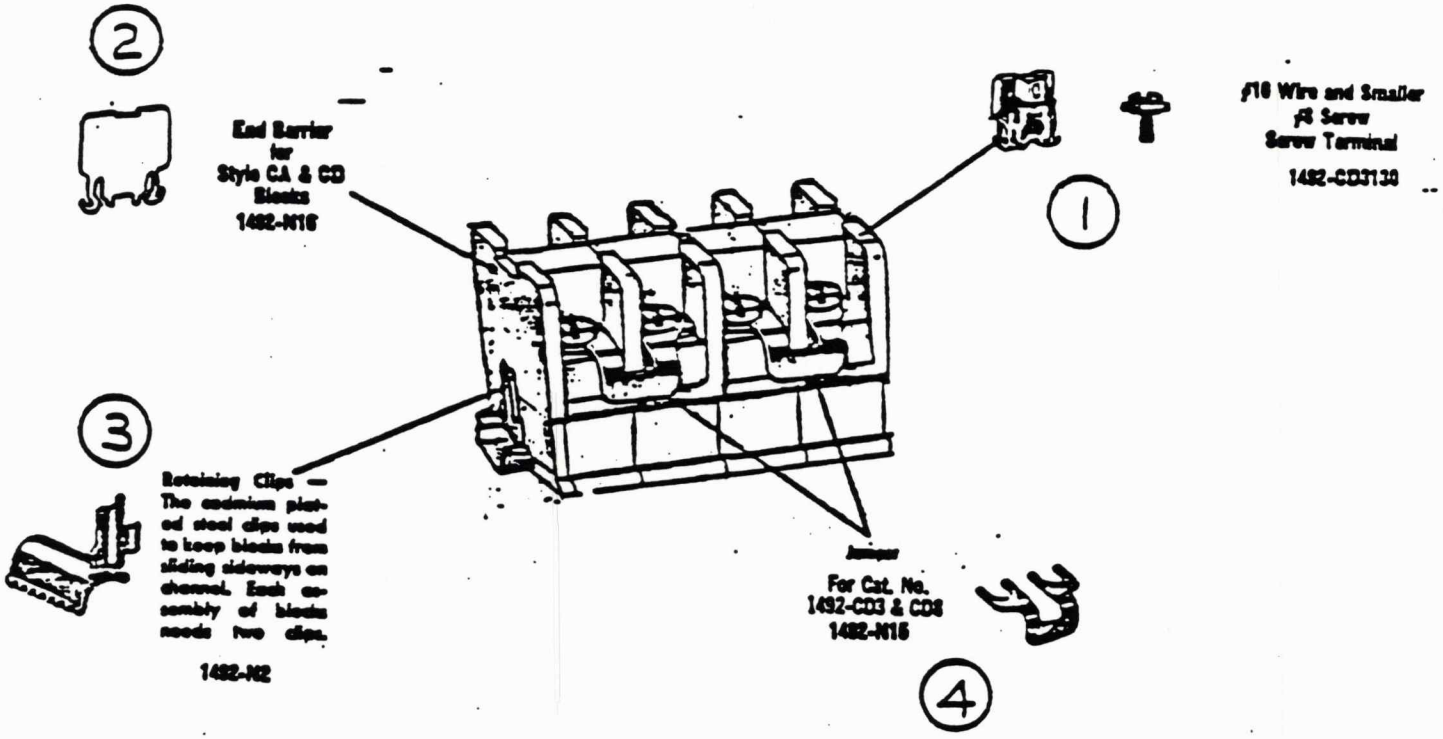
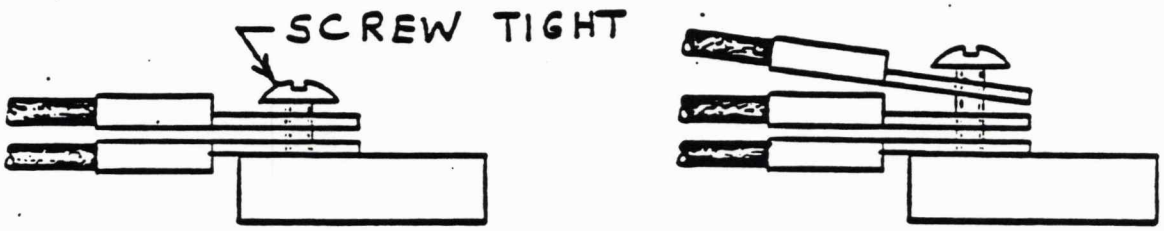


FIGURE 6.3
TERMINAL BLOCK CONNECTIONS



CORRECT:
2 LUGS, ONE RIGHT SIDE UP, ONE INVERTED

INCORRECT:
3 LUGS, BAD CONTACT & OVERHEATING LIKELY

JUMPER

BRIDGED TERMINALS ON A BARRIER STRIP

TO COMMON ADJACENT TERMINALS ON A TERMINAL STRIP, USE A JUMPER. IT DOES NOT COUNT AS A LUG IN THE 2 LUGS PER SCREW COUNT.

Figure 6.4
TERMINAL BLOCK PART LIST

ITEM	QTY	DESCRIPTION	MFG	MFG #	AMT #	AMS #
1		Terminal Block Strip, Series B 600V #10-22 Wire	Allen Bradley	CD 1492-CD3-130	25A9003953	
2		End Barrier for Item 1	Allen Bradley	1492-N16	25E9010171	
3		Retaining Clip for Item 2	Allen Bradley	1492-N2	23E9007470	
4		Jumper	Allen Bradley	1492-N15		
5		Power Terminal Block 3Pole, 3/8-16 x 1 3/16 stud	Marathon	1433563	25A7004463	
6		Terminal Block, 10 Pole	Strauss Engineering		25P4010702	
7		Terminal Strip 2 Point, 150V 15A Closed Back 6 - 32 x 3/16 Binder Screw (Exhaust Fan) 57000 & 11362			25K9012145	
8		Terminal Block, for 27 Point J-box Marathon 1600 Series OR AMTRAK-APPROVED EQUAL				

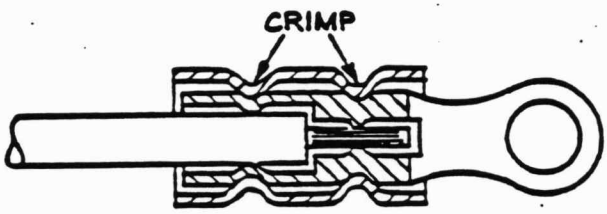
6.1.3 Electrical Lugs

Crimp-on type electrical lugs are used in large numbers throughout the car. They come in a variety of sizes to accommodate different wire gauges. The color of the lug indicates the wire gauge of which the lug can be used:

Yellow - 10 & 12
Blue - 14 & 16
Red - 18 - 22

Always use the correct lug for the wire gauge you are using. Too large a lug can not be properly crimped and will be loose; too small a lug requires a few strips of the wire to be cut off, which invites a burned off wire or lug.

Because of the severe vibration problems which a railway vehicle encounters, insulation-gripping lugs are a must. This type of lug is crimped onto each wire in two places: the wire itself and the insulator. This results in a much stronger connection which greatly reduces pullout and fatigue when the wire meets the lug.



Do not use economy-priced lugs. They are likely to fail in the rough railroad environment.

Different jaws or crimpers are required for different lug sizes. The correct crimping tool is as important as the lug. The plier-type tools produce poor quality crimps because there is no control of how tight the tool is squeezed. Rachet-type tools are highly recommended despite their greater cost because a proper crimp is virtually certain. Most burned lugs and intermittent connections can be blamed on poor crimps.

Crimp-on lug types:

A variety of lugs are available for different jobs:
See figure 6.5 and 6.6.

Ring Tongue

This lug is used to attach a wire to a stud or screw terminal. It comes in an assortment of sizes for both wire size and screw hole size. Always use a lug which fits the screw snuggly. Too large a hole results in 1) a poor electrical connection,. which can burn off a lug 2) a weak mechanical connection in which the lug may rip off the screw.

Do not use a spade lug in place of a ring tongue lug.. The ring tongue cannot fall off if the screw or nut is loose, but a spade lug will, and is likely to hit something it shouldn't.

When ring tongue lugs are used on a terminal block, only two lugs can be secured by each screw or stud; one right side up, one inverted. Stacking more lugs results in bad connections and often broken lugs or terminal strips. See figure 6.4.

Butt or Barrel Splice

This splice comes in a variety of wire sizes and is used to join two wires end to end. Note that both wires must be the proper gauge for the lug to be used. When using this part, be careful to insert the first wire only half way into the lug so both wires are properly crimped into place.

3-Way or T-Splice

This splice is used to connect three wires. Note all three wires must be the correct gauge for the splice to be used. This part is handy for floor heat and lighting circuit, where a string of heaters or fixtures is to be connected.

High Temp Ring Tongue

This lug is similar to the regular ring tongue except it is meant for high temperature use on heater elements, etc. The lug is not insulated because of the heat. Only high temperature lugs should be used on heater elements - not only because of the insulation, but the base metal differs as well, and a regular lug may break. Note that when electrical tape is needed in a high temperature application, only high temperature tape should be used; ordinary tape will burn and give off toxic fumes.

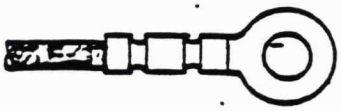
Pig Tail

Limited Use Only - not recommended. These lugs are used to join two wires side by side. The problem with these lugs is that often only one wire is securely gripped, and it is not evident. This is especially true if the wire sizes differ.

Faston

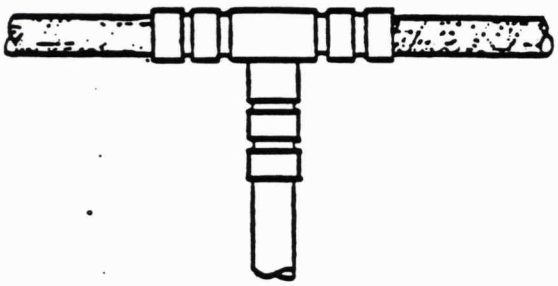
Limited Use Only - these lugs are to be used only on vendor supplied items on short leads, such as connections to relays or bridge rectifiers. FASTON's get loose easily.

LUGS & THEIR USE

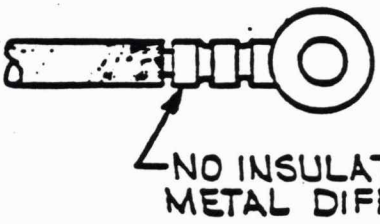


RING TONGUE

BUTT OR BARREL SPLICE



3 WAY OR T-SPLICE



HIGH TEMP-RING TONGUE

PIG TAIL LUG

FASTON

Figure 6
ELECTRICAL LUGS
PART LIST

Note: All Lugs are Insulation Grip Type

ITEM	QTY	DESCRIPTION			MFG	MFG #	AMT #	AMHS #
1		Ring Tongue Lug,	5/16", Stud, AWG 12-10		AMP	32546		
2		Yellow Insulation	1/4", Stud, AWG 12-10		AMP	32545		
3		(.165-.200	#10, Stud, AWG 12-10		AMP	32544		
4		wire size)	# 8, Stud, AWG 12-10		AMP	32543		
5			# 6, Stud, AWG 12-10		AMP	321500		
6		Ring Tongue Lug,	3/8", Stud, AWG 14-16		AMP	31908		
7		Blue	5/16", Stud, AWG 14-16		AMP	31905		
8		(.130-.145	1/4", Stud, AWG 14-16		AMP	31904		
9		wire size)	#10, Stud, AWG 14-16		AMP	51861-2		
10			# 8, Stud, AWG 14-16		AMP	51861-1		
11			# 6, Stud, AWG 14-16		AMP	51861		
12		Ring Tongue Lug	5/16", Stud, AWG 22-20-18-16		AMP	31895		
13		Red Insulation	1/4", Stud, AWG 22-20-18-16		AMP	31894		
14		(.?-.130	#10, Stud, AWG 22-20-18-16		AMP	31891		
15		wire size)	# 8, Stud, AWG 22-20-18-16		AMP	31890		
16			# 6, Stud, AWG 22-20-18-16		AMP	31885		
17			# 4, Stud, AWG 22-20-18-16		AMP	31880		
18		Butt Splice (Yellow)	AWG 12-10		AMP	320570	49A9000220	
19		Butt Splice (Blue)	AWG 14-16		AMP	320562	49A9000227	
20		Butt Splice (Red)	AWG 22-20-18-16		AMP	320559		
21		3-Way Splice (Yellow)	AWG 12-10		AMP	34074		
22		3-Way Splice (Blue)	AWG 14-16		AMP	53222-1		
23		3-Way Splice (Red)	AWG 22-20-18-16		AMP	50884		
24		High Temp Ring Tongue	#10 Stud	12-10	AMP	323750	25P9000660	
25		High Temp Ring Tongue	#10 Stud	16-14	AMP	322338		
26		Faston Lug, Female	.250 x .032	#12-10	AMP	160314-2		
27				#16-14	AMP	42332-2		
28				#22-18	AMP	42599-2		
29		Faston Lug, Female	.205 x .020	#16-14	AMP	42742-2		
30				#22-18	AMP	42888-1		
31		Faston Lug, Female	.187 x .020	#16-14	AMP	61697-1		
32				#22-18	AMP	60972-2		
33		Certi-Crimp Tool, Long Handle		12-10/16-14	AMP	59239-4		
34		Certi-Crimp Tool, Long Handle		16-14/20-16	AMP	47387		
35		Certi-Crimp Tool, Long Handle						

POWER PARTS COMPANY

1860 NORTH WILMOT AVENUE • CHICAGO, ILLINOIS 60647 • 312-772-4600

TWX 910-221-5507
TLX 20-6107

PRIVATE CAR KIT
CONVERSION FOR HEAD END POWER (H.E.P.)
COMPATIBLE WITH AMTRAK

IT.	Ordering Ref. PPC 16300 FULL	PPC 16298 1/2	PPC 16297 1/4	PPC No.	DESCRIPTION
1	4	2	1	16284	480V FIXED JUMPER
2	4	2	1	16286	480V RECEPTACLE
3	4	2	1	12977	RECEPTACLE HOUSING
4	4	0	0	16287	27 PT. RECEPTACLE
5	1	0	0	16288	27 PT. JUMPER
6	1	1	1	16289	480V JUNCTION BOX
7	2	0	0	16290	27PT. JUNCTION BOX
8	24	12	6	16291	INSULATING SLEEVE
9	100	50	25	16292	NEOPRENE CLEAT
10	24	12	6	16293	CORD GRIP
11	48	24	12	16294	# 4/0 LUGS

FULL	H.E.P.	PPC 16300	$5,800.00
1/2	H.E.P.	PPC 16298	$2,130.00
1/4	H.E.P.	PPC 16297	$1,390.00

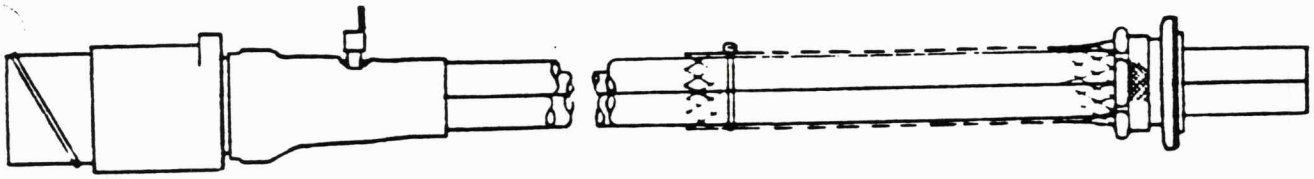
WIRE AVAILABLE SEPARATELY (APPROXIMATE QUANTITY REQUIRED SHOWN)

	FULL	1/2	1/4	PRICE	DESCRIPTION
12	1100'	500'	250'	$ .17/ft	#10, 27/24, 600V.
13	1600'	0	0	$ .11/ft	#12, 19/25, 600V.
14	500'	0	0	$ .57/ft	#14/2, Shielded Wire
15	1000'	500'	250'	$4.71/ft	#4/0, 600V, AAR 591

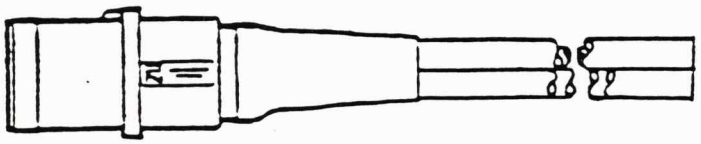
F.O.B.: CHICAGO, ILLINOIS

TERMS: 2% 15 Days NET 30.

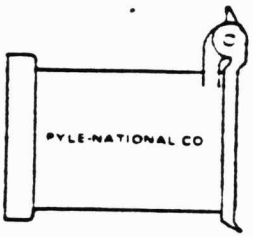
(4/25/86)



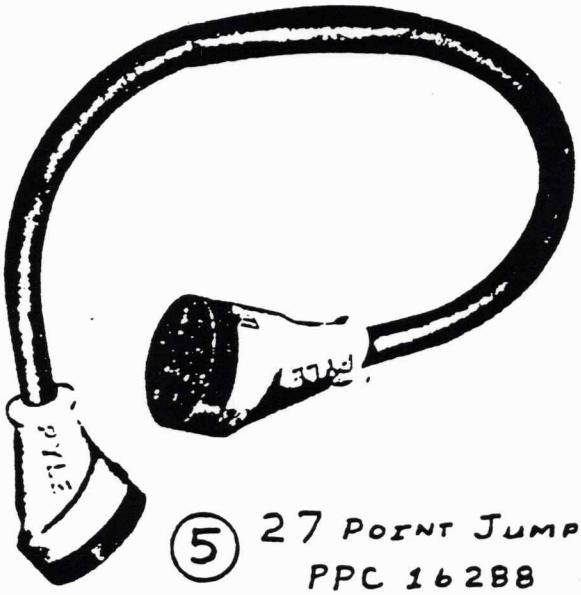
(1) 480 VOLT FIXED JUMPER
PPC 16284



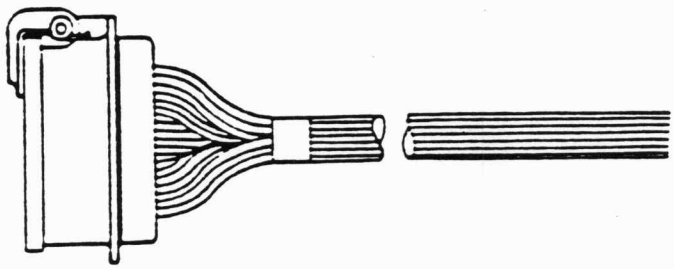
(2) 480 VOLT RECEPTACLE
PPC 16286



(3) 480V. RECEPTACLE HOUSING
PPC 12977



(5) 27 POINT JUMPER
PPC 16288



(4) 27 POINT RECEPTACLE
PPC 16287

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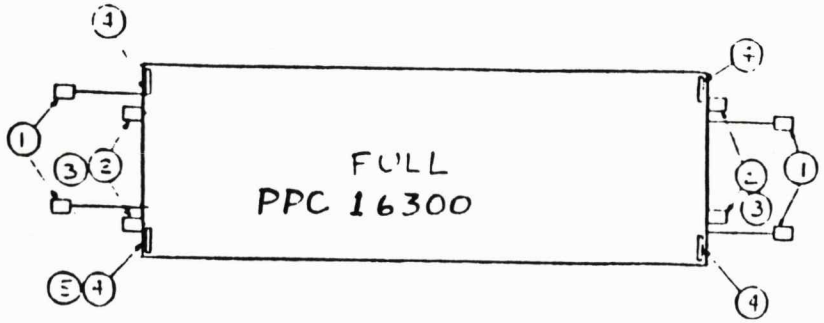
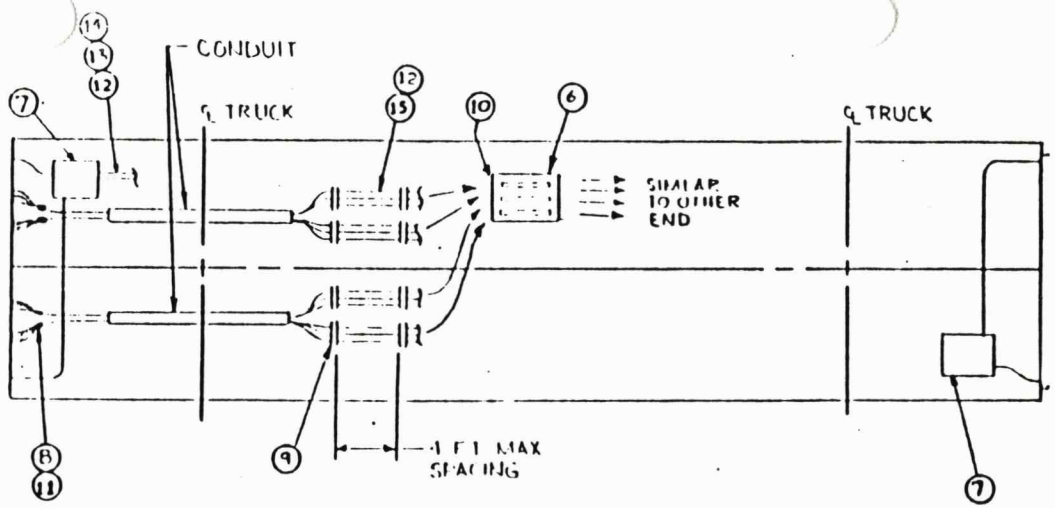
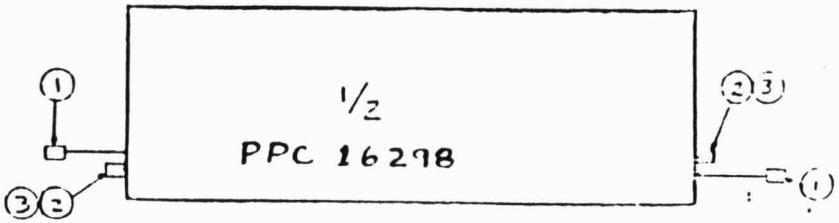
Area Code 312 / 772-4600 • TWX 910-221-5507

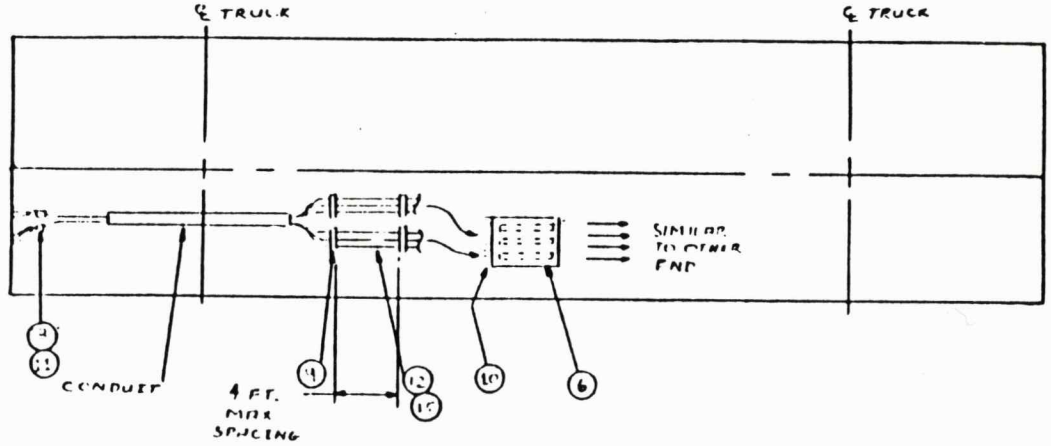
TYPICAL

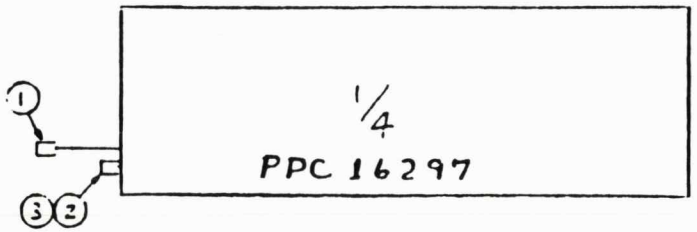
480 VOLT UNDERCAR COMPONENTS

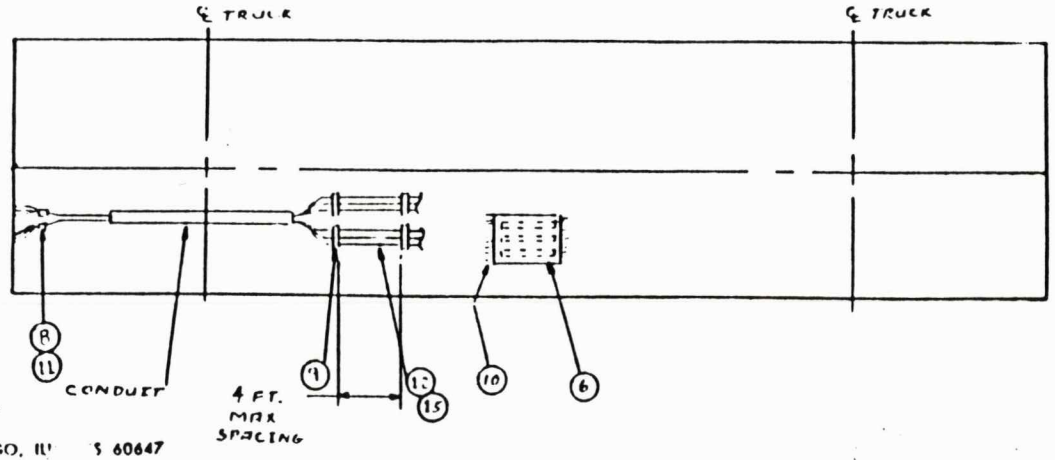












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Area Code 312 / 772-4600 • TWX 910-

SECTION VI

SPECIFICATION CONVENTIONAL CAR TO HEAD END POWER

3

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
_____	_____
_____	_____
_____	_____
_____	_____

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, 9½	Clarified conduits req'd for 480 control, MU and 27 Pt. Comm. Trainline
D	10/4/87	15	Revised drawing list
		16	Added Specification List
		17	Test 6.2.2 was 6.8
		17	Added Test 6.2.6 B
E	6/12/89	14	FDB was FB; EHD was EHB
		13	Revised paragraph c to clarify.

INDEX

PRIVATE CAR SPECIFICATION

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.

This spec is to be used as a supplement to Mechanical Instruc-
*B tion 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 Automative 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

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

*B 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

*B 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 fixutre 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

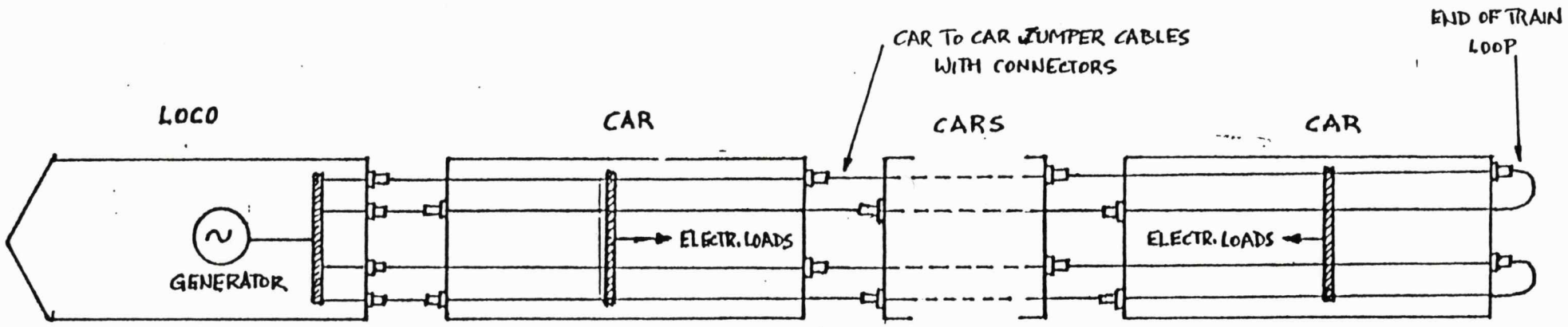
a. General Wiring

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



H. KOLIG
11/20/86

*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 hydraulicly crimped with appropriate tools, as recommended

*B by the lug manufacturer. See Figure 6.

c. 480 Control Wiring

This wiring shall comply with Drawing #E-01-1306. It shall be run in a separate rigid galvanized steel conduit.

*C 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

*B vital circuits. Also see Figure 6.

*C a. 27 Point Trainlines

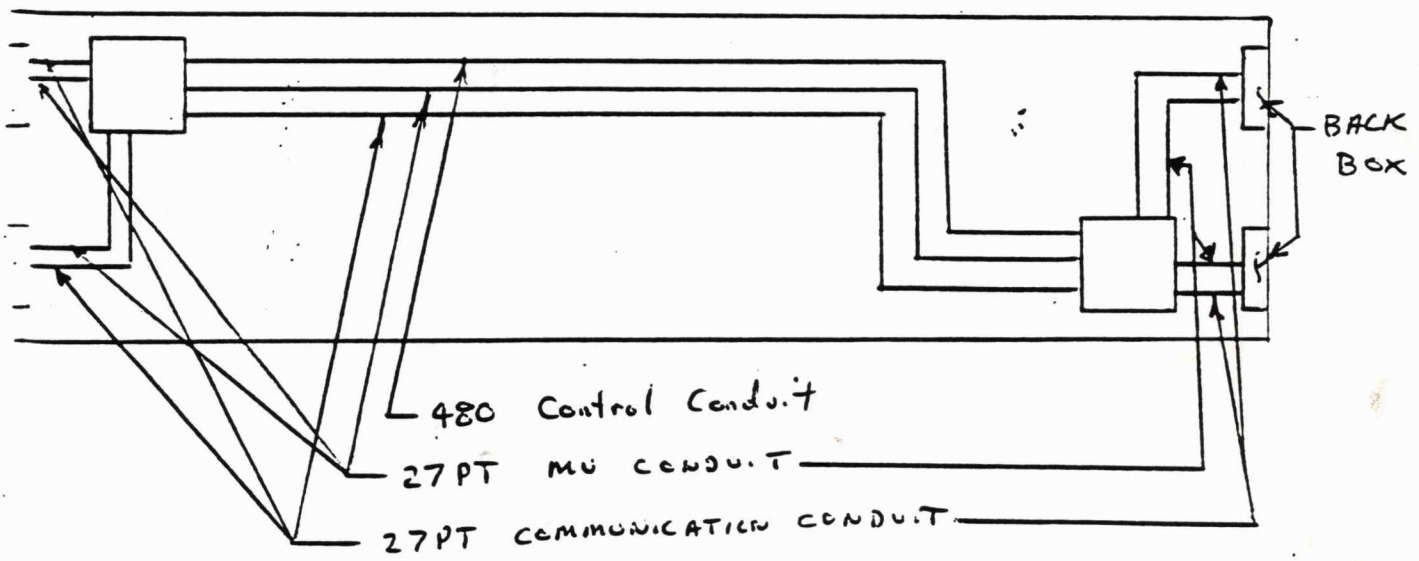
The rear of these receptacles shall be enclosed in a water-tight stainless steel box. (Back of receptacles is not intented for exposure to weather.)

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 MU 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 MU 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 porition 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 ón 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.

*E

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 bundled 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

*B E-01-1306 and Figure 7.

e. 480 Volt Main Circuit Breaker

The 480 volt main circuit breaker shall be Westinghouse 3

*E 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.

f. 480 Volt Breakers

All other 480 volt circuit breakers are to be Westinghouse

*E type EHD

(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

RFB 102986	"LISTENING IN"
FIG 3	HEP TRAINLINE CONNECTOR LOCATIONS
C-05-7171	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-05-1355	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
*	6.2.2	480V Trainline Cable
*	6.2.6B	PRIVATE CAR ELECTRICAL LOAD/PHASE BALANCE
	10.2	Carbody Leveling

SECTION VII

PRIVATE CAR H.E.P. CONVERSION INSPECTION

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, *C or approved equal 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 hydraulicly 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 a 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 (Cover 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

*B e. All bolts to be tight

14. Inspect 27 point J-1 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 ~~screws~~ terminals 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 FRA. 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 ½".

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 3/4-1½" 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
*B 6.2.6B Private Car Electrical Load / Phase Balance
10.2 Leveling of Carbody

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.

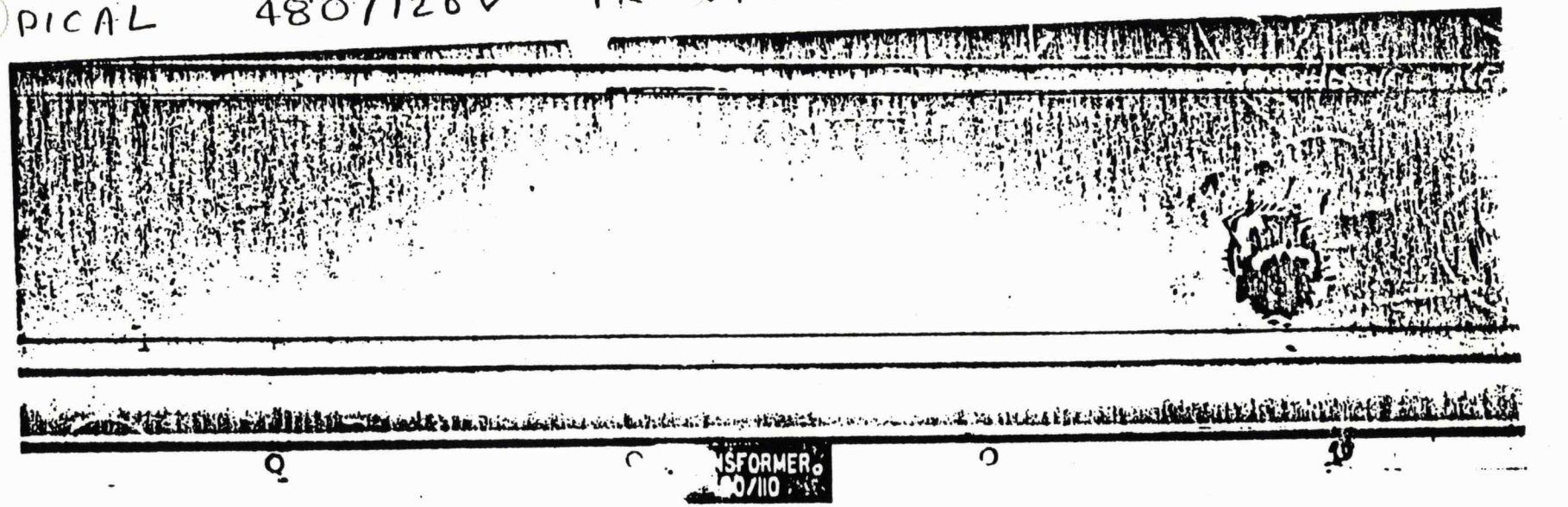
If questions arise concerning interpretation of spec., CONTACT SUPERINTENDENT, CAR MAINTENANCE, WHO WILL IN TURN CONTACT EQUIPMENT ENGINEERING, AS REQUIRED.

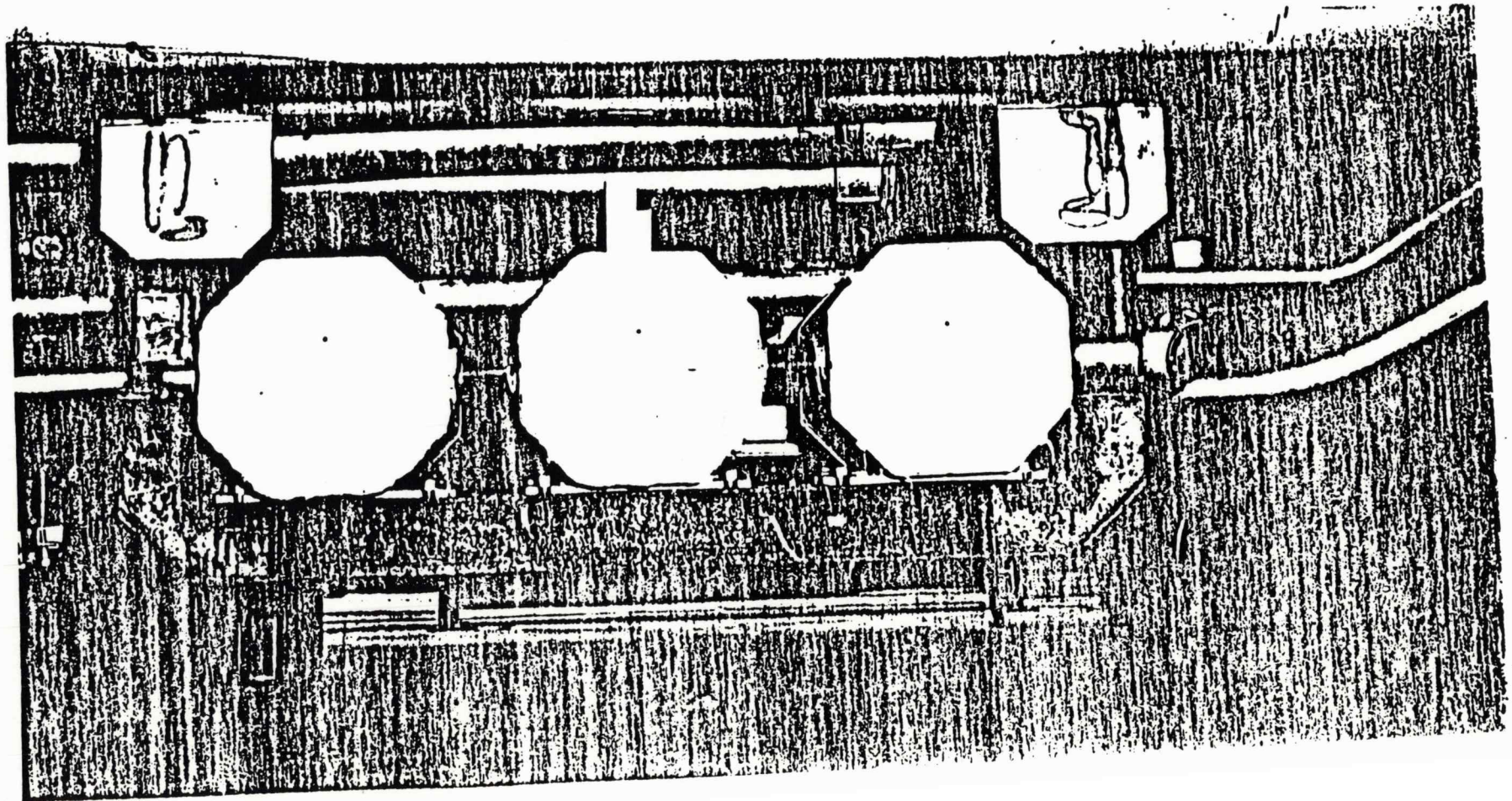
MCHSP.110/dsy

SECTION VIII

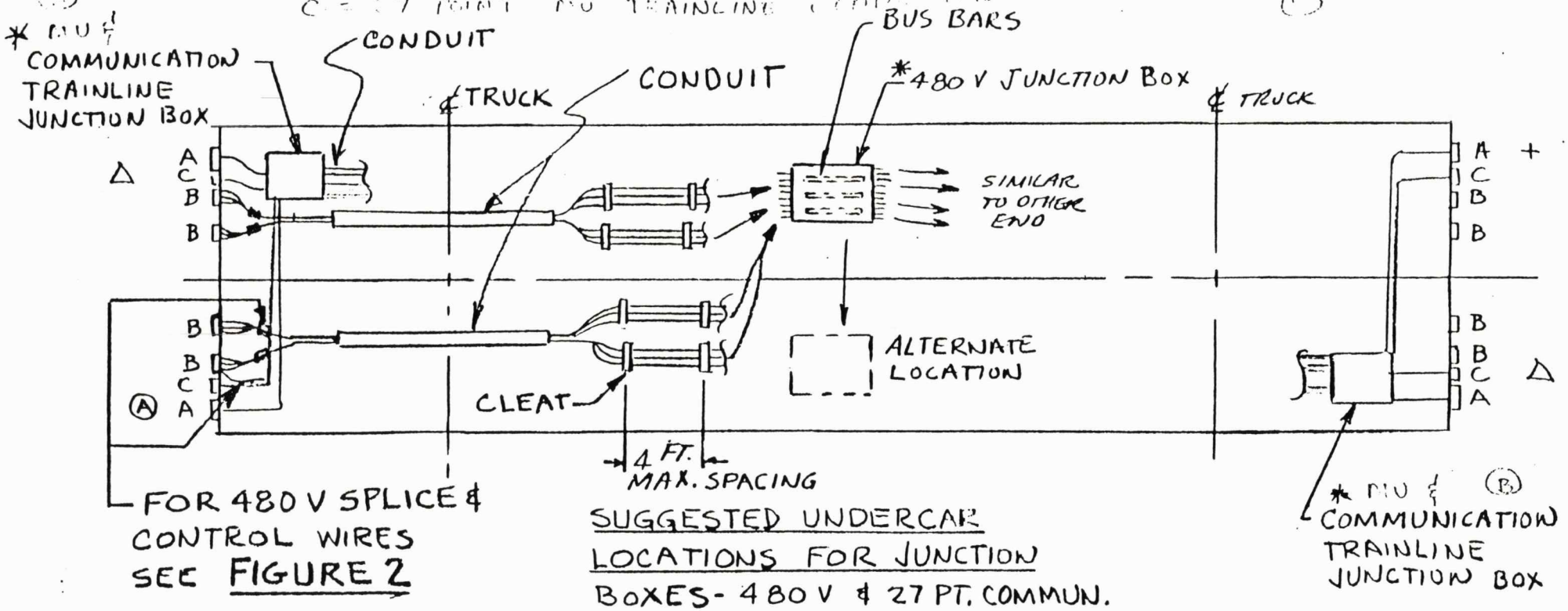
ILLUSTRATION

PICAL 480/120V TR 3FORMER INSTALLATION





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



* APPROXIMATE LOCATIONS FOR JUNCTION BOXES (PREFERRED) SPACE REQUIREMENTS MAY DICTATE FINAL LOCATION OTHERWISE

△ MU SYSTEM OPTIONAL

FIGURE 4

Ⓑ REV B 10-67

Ⓐ - REV A 10-66

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

SCALE - NONE

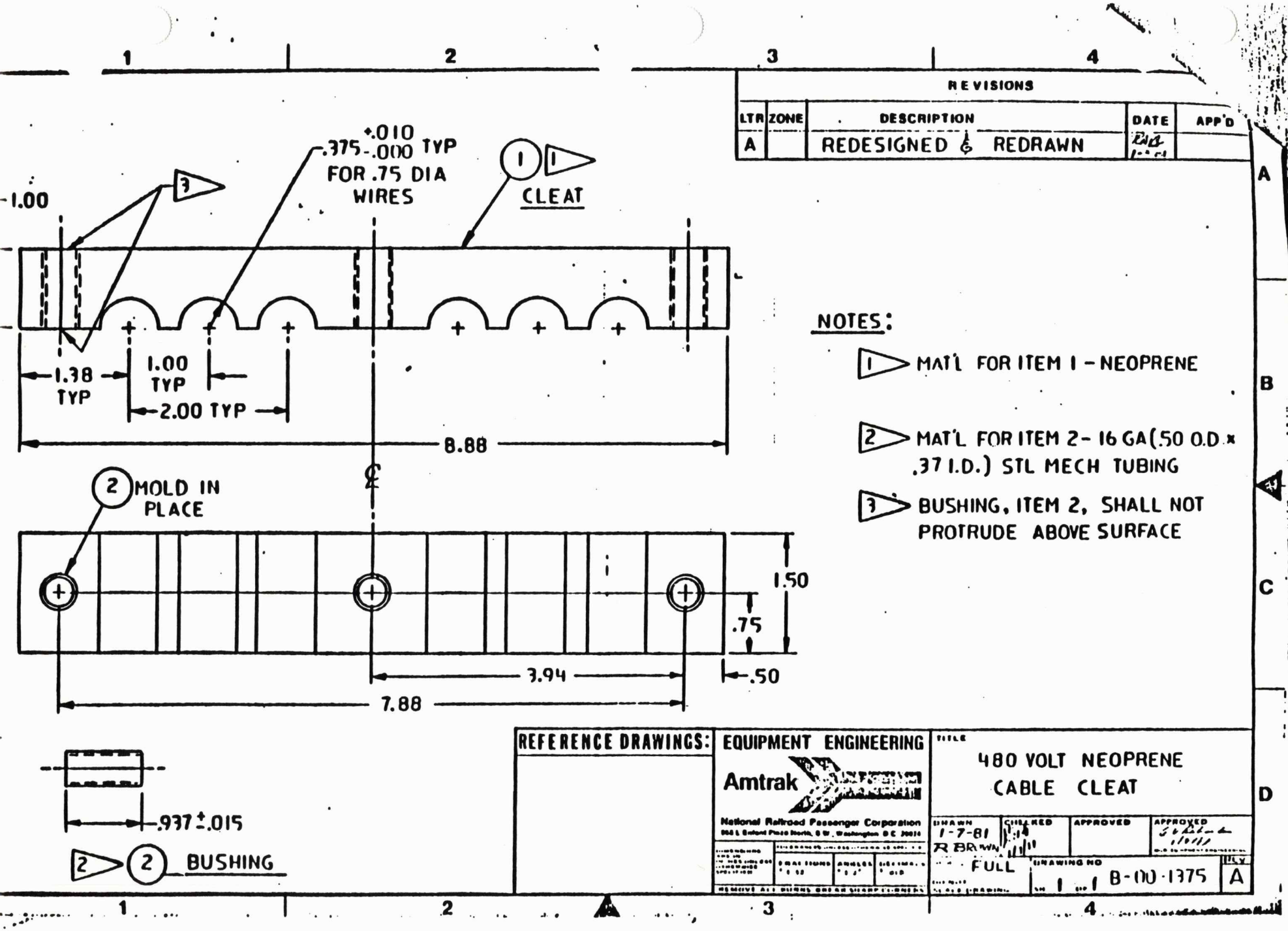
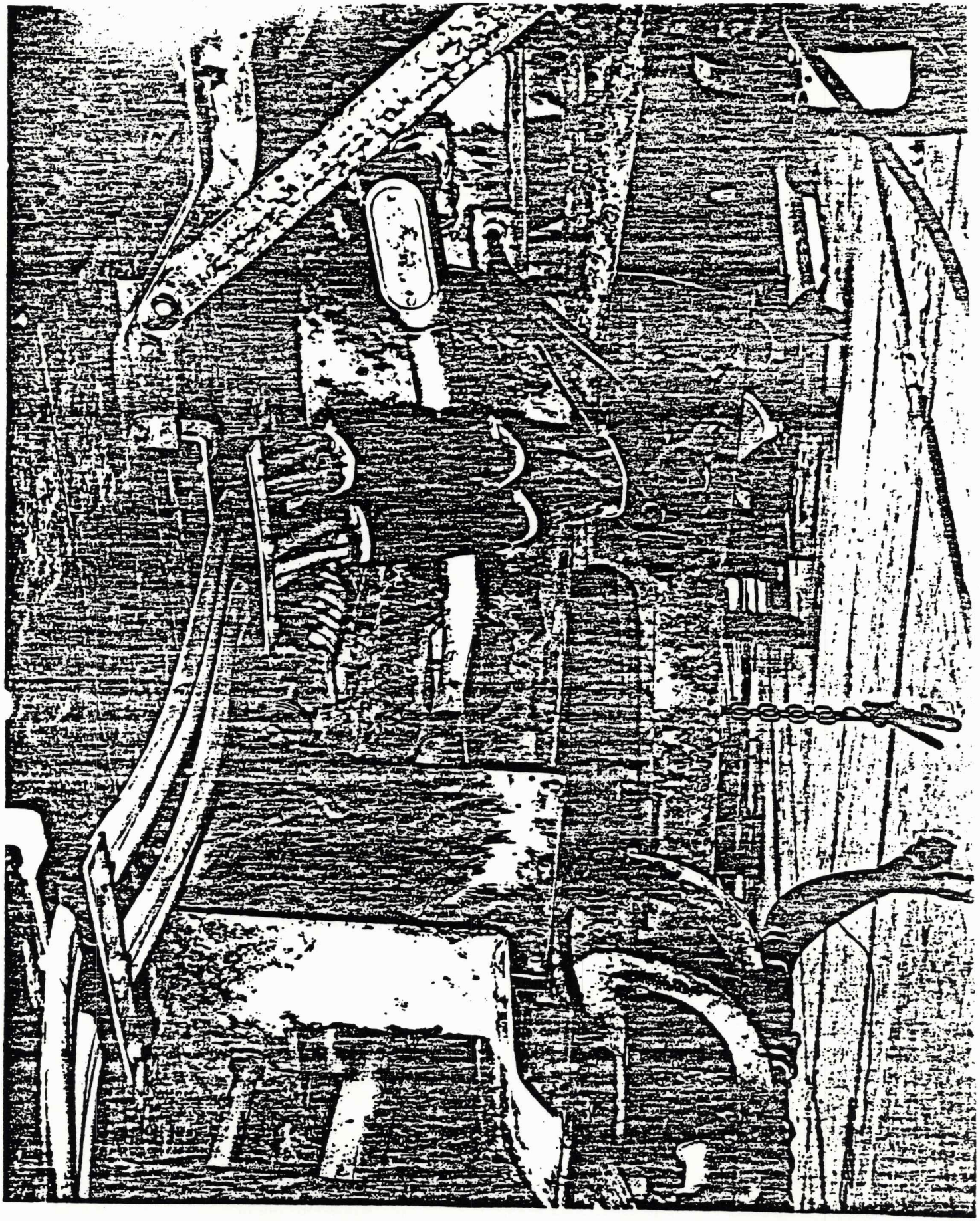
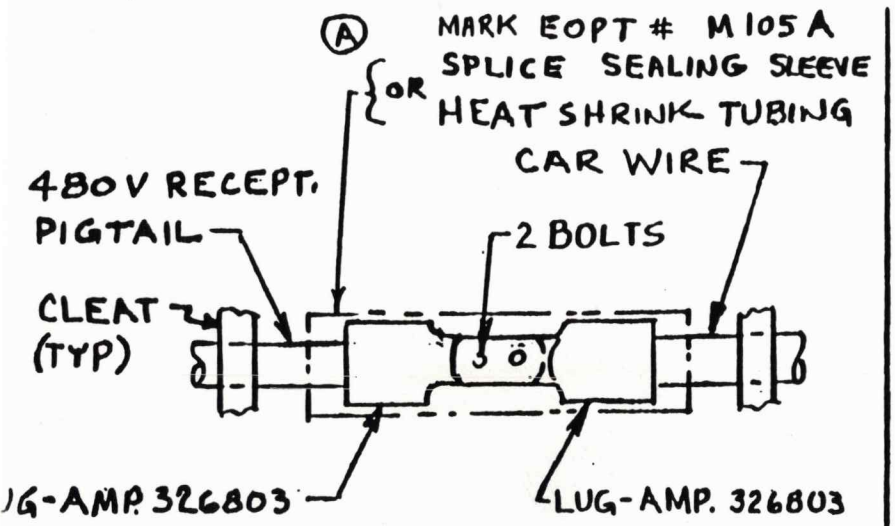

REVISIONS
LTR ZONE DESCRIPTION DATE APP'D
A REDESIGNED & REDRAWN
+.010
.375-.000 TYP
FOR .75 DIA
WIRES
CLEAT
1.00
1.38 TYP
1.00 TYP
2.00 TYP
8.88
MOLD IN PLACE
1.50
.75
.50
3.94
7.88
.937 ±.015
BUSHING
NOTES:
MAT'L FOR ITEM 1 - NEOPRENE
MAT'L FOR ITEM 2 - 16 GA (.50 O.D. x .37 I.D.) STL MECH TUBING
BUSHING, ITEM 2, SHALL NOT PROTRUDE ABOVE SURFACE
REFERENCE DRAWINGS:
EQUIPMENT ENGINEERING
Amtrak
National Railroad Passenger Corporation
TITLE
480 VOLT NEOPRENE CABLE CLEAT
DRAWN 1-7-81 R BROWN
CHECKED
APPROVED
APPROVED
FULL
DRAWING NO B-00-1375
SIZE A
SCALE
1 2 3 4
A B C D

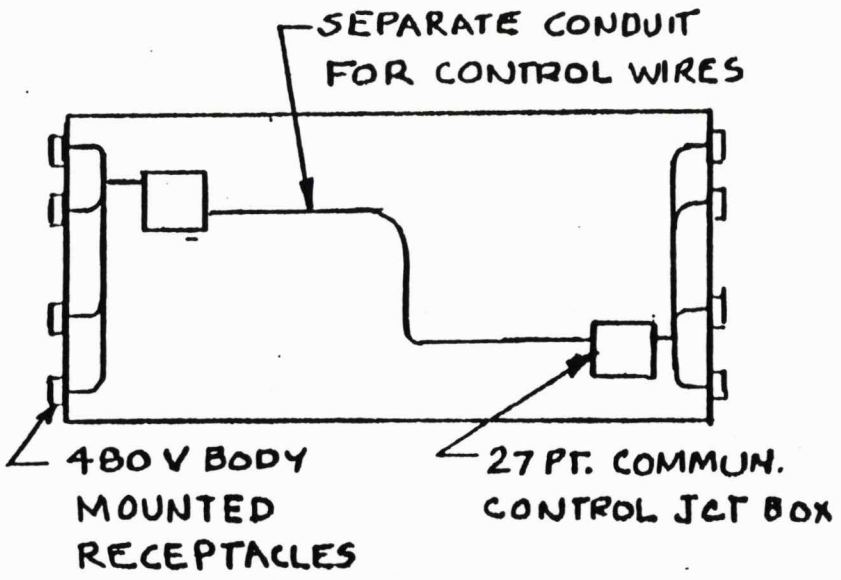
FIGURE - 4A



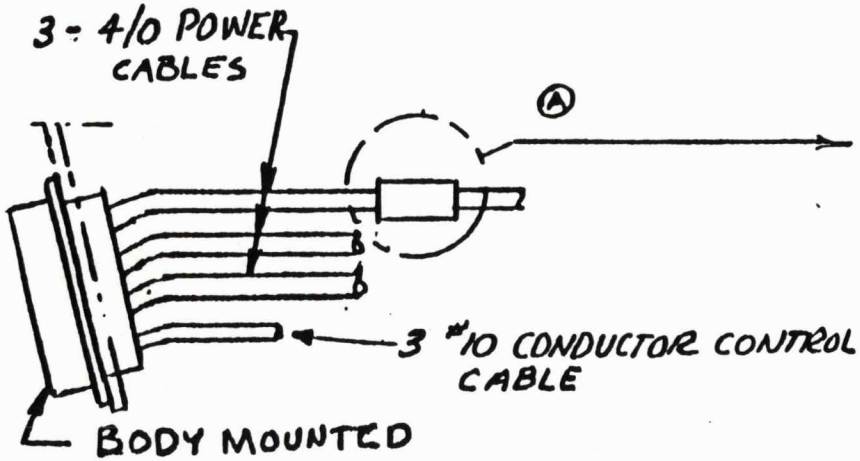
TYPICAL INSTALLATION OF
480 V PIGTAIL SPLICES

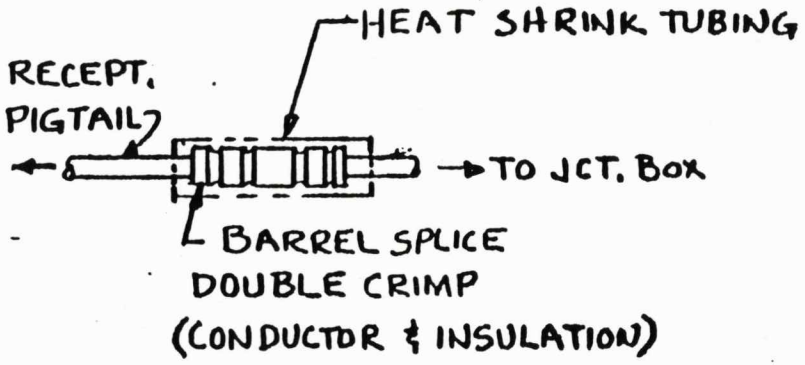


480 V POWER WIRE



480 V CONTROL WIRES



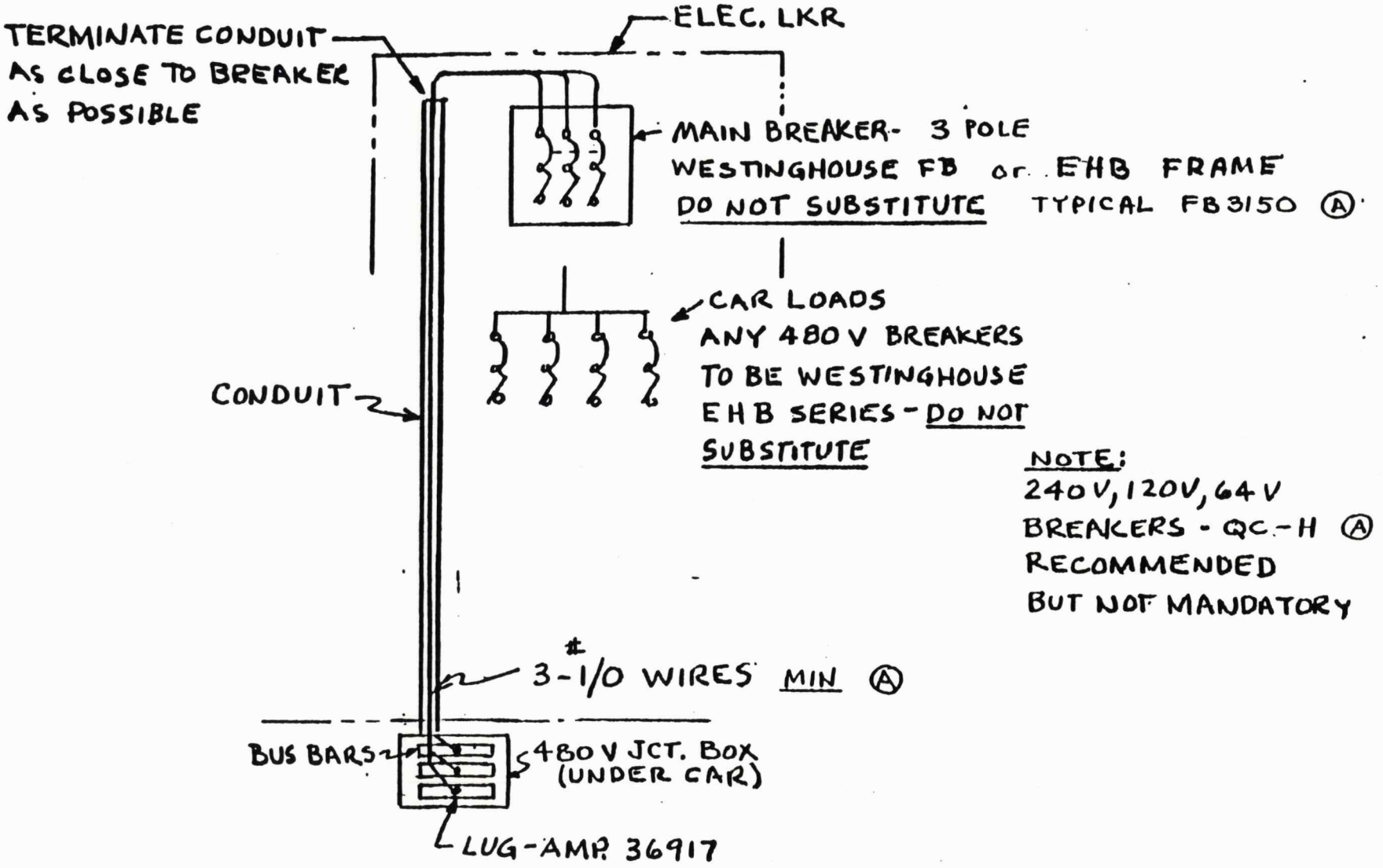


SPLICE - IF USED

480V POWER AND CONTROL WIRE CONNECTION DETAILS

SCALE - NONE

FIGURE 6



480 V TRAINLINE TAP TO PRIVATE CAR

FIGURE 7

D-00-1312

REVISIONS			
ITR	DESCRIPTION	DATE	APPD

FIXTURE DATA					LAMP DATA					
MARKER LIGHT MODEL NUMBER	MANUFACTURER	TYPE	AMTRAK PART NUMBER	FRA APPROVED IDENTIFICATION	MFG.	TYPE	VOLTS	WATTS	AMTRAK PART NUMBER	REMARKS
FM-5435-1	TRANSLITE		25A4000230	FRA ATK TL 5435-1	G.E.	60/PAR/2/R RED	58	60	25A4000001	AMFLEET I H.E.P. CARS
001890-001	LUMINATOR		25E5000102	FRA-ATK-LUM 001890-001	G.E.	60/PAR/2/R-RED	58	60	25A4000001	SUPERLINER I H.E.P. CARS
FM-4491-1	TRANSLITE		25N9010927	FRA ATK TL 4491-1	G.E.	60/PAR CLEAR	58	60	25K9011223	PORTABLE USE WITH FLAG BRACKETS ETC...
FM-4491-2	TRANSLITE		25K9010928	FRA ATK TL 4491-2	G.E.	75/PAR/36/RS CL	75	75	25U9011222	"
FM-4491-3	TRANSLITE		25K9010929	FRA ATK TL 4491-3	G.E.	150/PAR/46/3-CL	175	150	25T9011221	"
FM-4735-1	TRANSLITE 'RED CENTER'		25L9011228	FRA-ATK TL-4491-1	G.E.	60/PAR/38/SB-CL	38	60	25K9011223	PORTABLE UNIT. PLUGS INTO BATTERY T/L RECPT.
FM-4735-2	TRANSLITE 'RED CENTER'		25N9011229	FRA-ATK-TL-4491-2	G.E.	75/PAR/36/RS-CL	75	75	25U9011222	"
FM-4735-3	TRANSLITE 'RED CENTER'		25P9011230	FRA-ATK-TL-4491-3	G.E.	150/PAR/46/3-CL	175	150	25T9011221	"
845-F	STAR		25D9010902	FRA-BN-STAR 845F	G.E.	1195	12	3.0AMP	25X9011288	SELF-POWERED COMPLETE W/ BATTERY UNIT & CHARGER
L-13-4459X-5	McDERMOTT		25P9012474	FRA-MEL-MLD-100-F		PAR/46	12	30	25H9012476	"
WERT-12V DWG. D-80109	WHELAN		25X9011193	FRA-ATK-WHE-WERT12		PAR/46	12	30	25H9012476	"
RC 4193	TRANSLITE		25L9012475	FRA-ATK-TL-RC-4193	G.E.	60/PAR/2/R RED	58	60	25A4000001	ARROW II CARS
FM 4715	TRANSLITE		25D9012477	FRA-ATK-TL-FM-4715	G.E.	60/PAR/2/R-RED	58	60	25A4000001	METROLINER CARS
FM 4754	TRANSLITE		25X9012478	FRA-ATK-TL-FM-4754	G.E.	60/PAR/2/R RED	58	60	25A4000001	METROLINER CARS
MS-0602-1	GRIMES		25T9012479	FRA-ATK-GR 0602-1	G.E.	60/PAR/2/R-RED	58	60	25A4000001	L.R.C. TRAIN
P/N 21079	DOWNMAN ASSOC.		25X9012185	FRA-ATK-DOW-21079	G.E.	60/PAR/2/R-RED	58	60	25A4000001	COMMUTER CARS

TO USE BATTERY T/L RECEPTACLE POWER, USE TRANSLITE FM 4491-3 ADAPTER PLUG P/N 25L9011231.

FIXTURE USED IS TYPE FM-4491 TYPE FM-4735 DENOTES HOODED TRAINLINE PLUG ONLY.

QTY/CAR	USED ON

REFERENCE DRAWINGS:

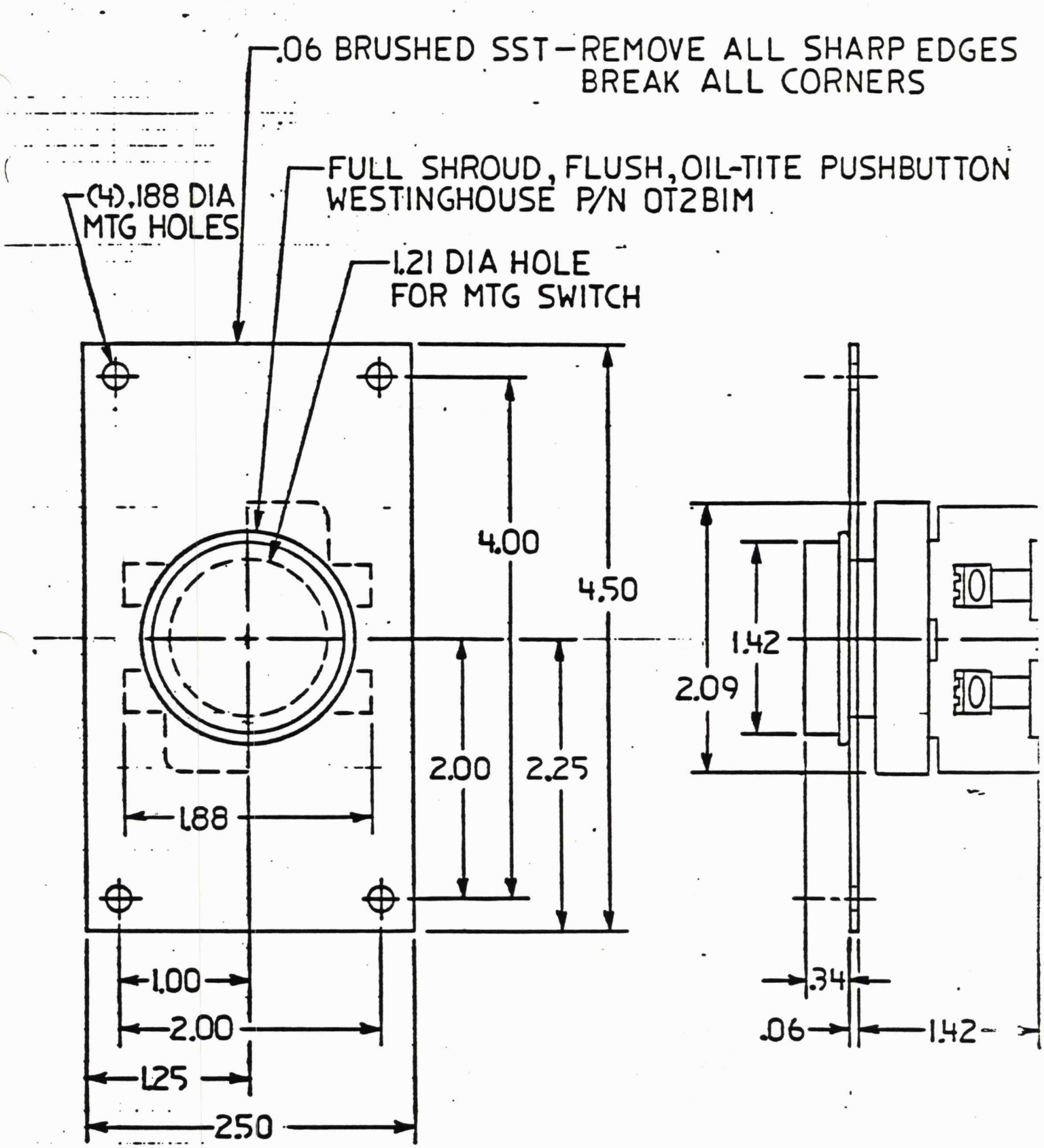
EQUIPMENT ENGINEERING

Amtrak

AMTRAK MARKER LIGHTS FRA APPROVED LIST

D-00-1312

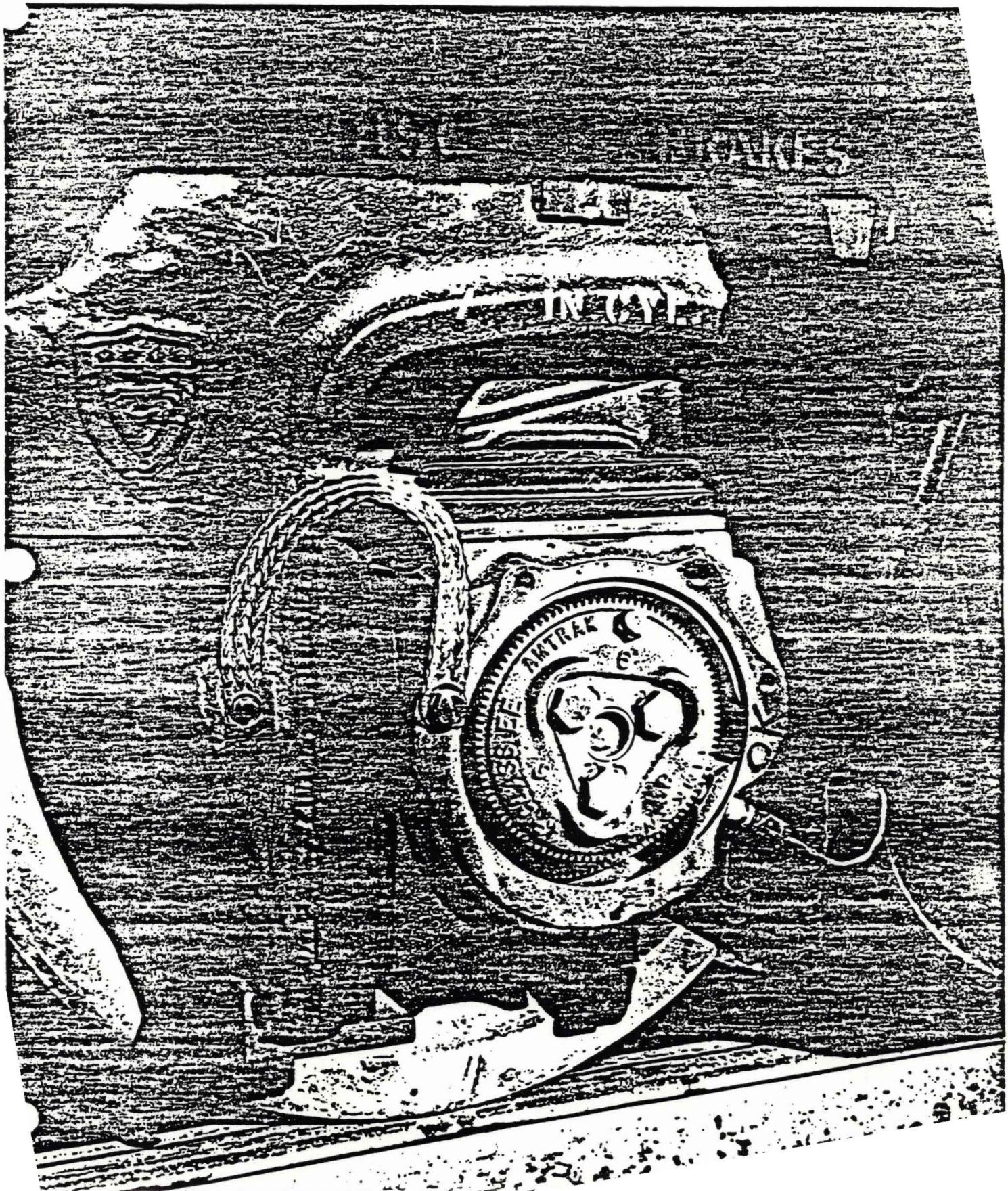
FIG 8



DWG NO. SK-A-120980

PUSHBUTTON

FIG 10
TYPICAL GROUND STRAP
INSTALLATION



SECTION IX

TESTS

1.1 UNDER CAR CLEARANCE

1.2 CURVING

2.3 TRAINLINE POWER

2.4 TRAINLINE 27 POINT

6.2 MEGGER

6.8 480V TRAINLINE CABLE INSULATION

10.2 LEVELING OF CARBODY

Test Section 1.1

Test Name CAR UNDERCAR CLEARANCE

Revision - Date 4-17-79

Applies to car series:

All HEP & conventional cars.

SECTION 1.1 CAR CLEARANCE TEST - UNDER CAR

1.0 SCOPE:

The purpose of this test is to insure that it is built within the clearance diagram as shown on Amtrak Dwg. #D-322.

2.0 EQUIPMENT REQUIRED:

Template per Figure I.

3.0 DRWG REQUIRED:

Amtrak clearance diagram Dwg. #D-322.

4.0 PROCEDURE:

Slide template on top of tracks perpendicular to rail. The car violates the clearance restrictions if any part other than the trucks come in contact with the clearance template.

Modifications must be made to eliminate the points of interference.

End of Test

Test Section 1.2

Test Name CAR CURVING AND TRUCK CLEARANCE

Revision - Date 4-17-79

Applies to car series:

All HEP converte' cars.

SECTION 1.2 CAR CURVING AND TRUCK CLEARANCE TEST

1.0 SCOPE:

This test is to be performed on one completed car of each type having a different truck/carbody interface, different truck centers, or different truck wheel base to insure adequate clearance between the underside of the carbody and truck-mounted equipment. The test should be performed with the car meeting all requirements in Section 5, and with full water tanks, batteries, and simulated passenger load.

2.0 EQUIPMENT REQUIRED:

2.1 Transfer Table

2.2 Wheel Chocks

2.3 Four vertical car 50 ton jacks.

3.0 PROCEDURE:

3.1 With the car on straight tangent track, check for 3 inches minimum lateral clearance between the underside of the carbody and truck-mounted equipment.

3.2 Place the car with one truck on the transfer table and the other off. Place blocks against the wheels of one axle of the truck off the transfer table.

3.3 Move the transfer table through a distance sufficient to simulate the truck yaw on a 23° curve. For cars with 59 feet 6 inches truck centers, the displacement of the transfer table must be 87 inches. For cars with other truck centers, the distance to move the transfer table must be calculated. Refer to Figure 1.

3.4 After the transfer table has been moved, a check for clearance between the truck and car underframe, and that slack exists in the grounding wires, hand brake rigging, wheel slip sensor cables, dump valve piping, and brake cylinder hoses.

3.5 Maintain the relative lateral distance between the truck centers, and place a vertical car jack under eack jacking pad on one side of the car. Jack the side of the car until the carbody bolster at the jacking pad has moved 3 1/8 inches. Refer to Figure 2.

3.6 With the car tilted, perform the same checking procedure as in (4), above.

3.7 Check for 3 inches minimum lateral clearance between the underside of the carbody and truck-mounted equipment. Adequate slack in truck to carbody hoses and electrical wiring should be judged for a relative lateral movement between truck frame and carbody.

3.8 Release the vertical jacks.

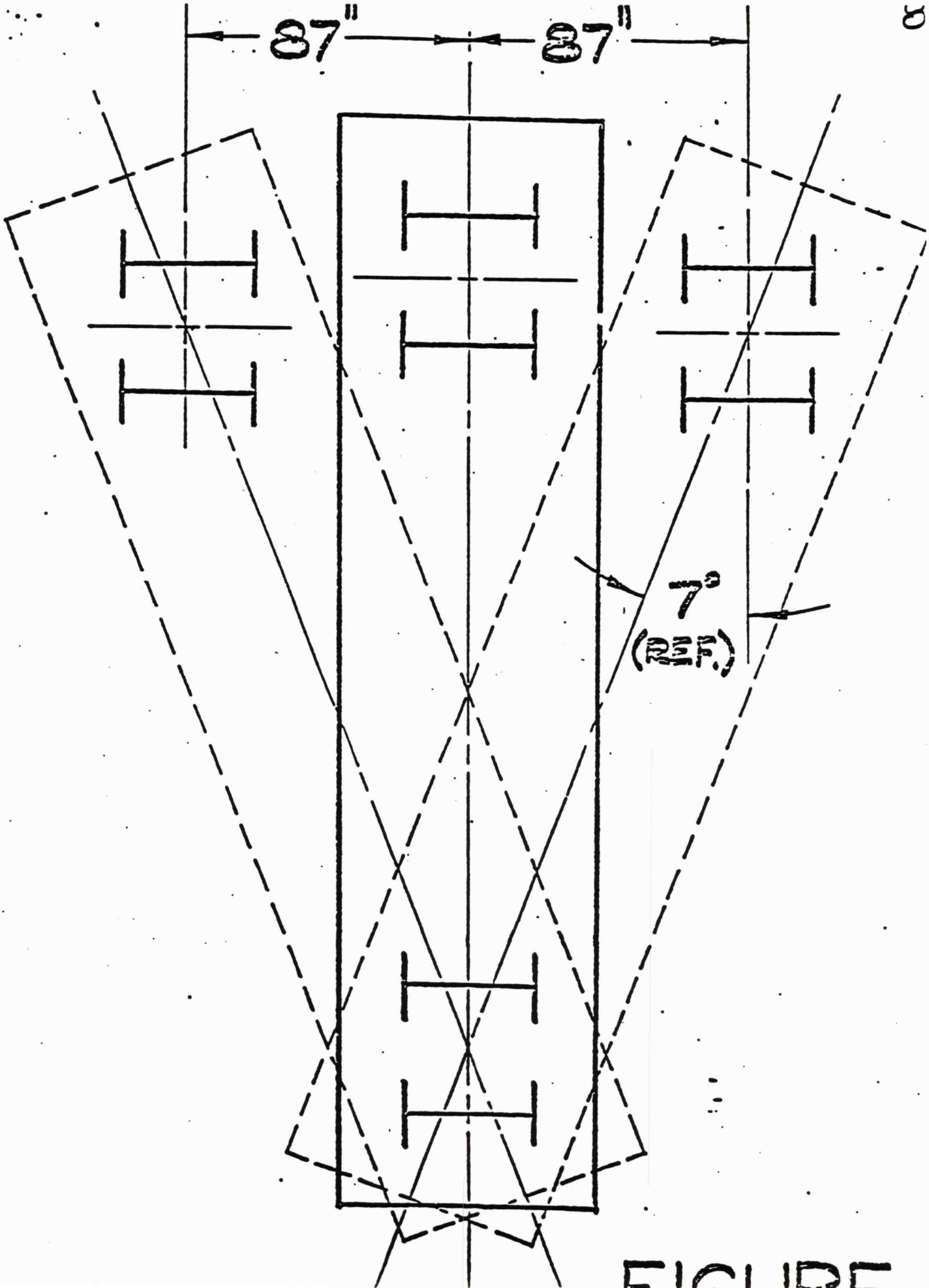
3.9 Jacks the other side of the car in the same manner as described in Step 5, and perform the same checking procedure as in 3.6 through 3.8.

3.10 Move the transfer table laterally in the opposite direction until the trucks have been displaced an equal distance from the centerline simulating tangent track.

3.11 Repeat steps 3.3 through 3.9.

Test complete.

End of Test



FIGURE

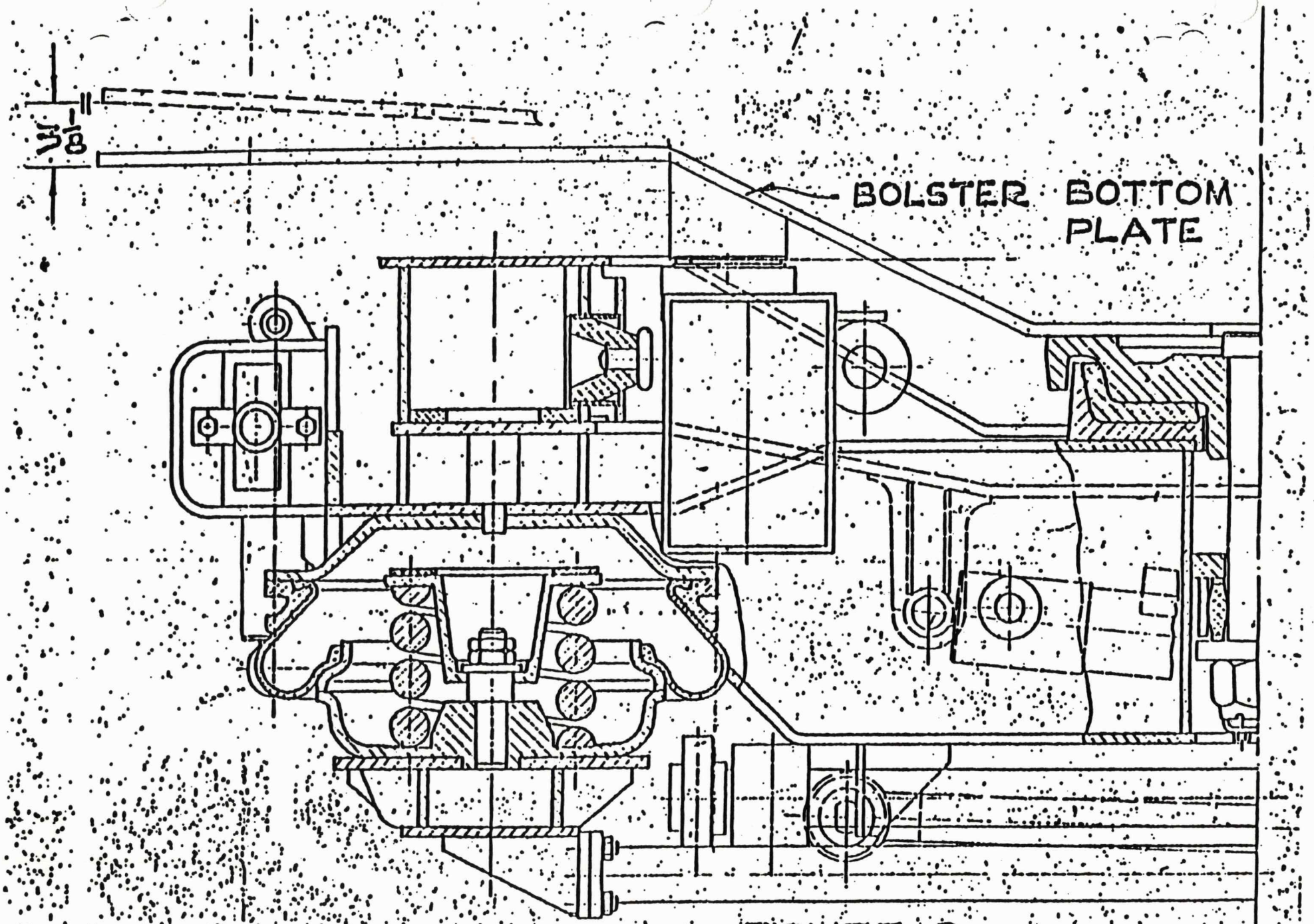


FIGURE 2

SECTION 2.3 TRAINLINE TEST

PART A - 480V POWER TRAINLINE (OHMMETER METHOD)

1.0 SCOPE:

The subject test is performed to satisfy the requirements of the Amtrak Specification.

2.0 WHEN USED:

This test is to be performed on each car.

3.0 DEGREE OF CAR CONSTRUCTION:

This procedure is to be applied to the car under test after all carbody wiring and equipment has been installed and connected. The car shall have been successfully tested to Sections 6.1, 6.2, 6.3.

4.0 LOCATION OF TEST:

The subject test shall be performed at the carbuilders plant.

5.0 APPLICABLE DOCUMENTS:

Amtrak Drawings - E-01-1306

6.0 TEST EQUIPMENT:

Volt-ohmeter: John Fluke Model 8000 or equivalent.

7.0 PROCEDURE:

7.1 Preliminary: Remove all 480 jumper cables from the car.

All the following continuity readings must read 2 ohms or less.

7.2 480 T/L REceptacles - Power Pins. Refer Figure I for receptacle locations.

Ring large pin 1 between receptacles A-end 1-2, 1-3, 1-4

Ring large pin 2 between receptacles A-end 1-2, 1-3, 1-4

Ring large pin 3 between receptacles A-end 1-2, 1-3, 1-4

7.3 Ring large pin 1 between receptacles B-end 1-2, 1-3, 1-4

Ring large pin 2 between receptacles B-end 1-2, 1-3, 1-4

Ring large pin 3 between receptacles B-end 1-2, 1-3, 1-4

7.4 Ring A-end to B-end receptacle 1 to receptacle 1

Large Pin #1

Large Pin #2

Large Pin #3

480 T/L Receptacles - Control Pins

7.5 Ring small pin 1-1 A-end to B-end 4-1

2-1 3-1

3-1 2-1

4-1 1-1

1-3 4-3

4-3 1-3

7.6 Ring small pin 2-3 A-end to A-end 3-3

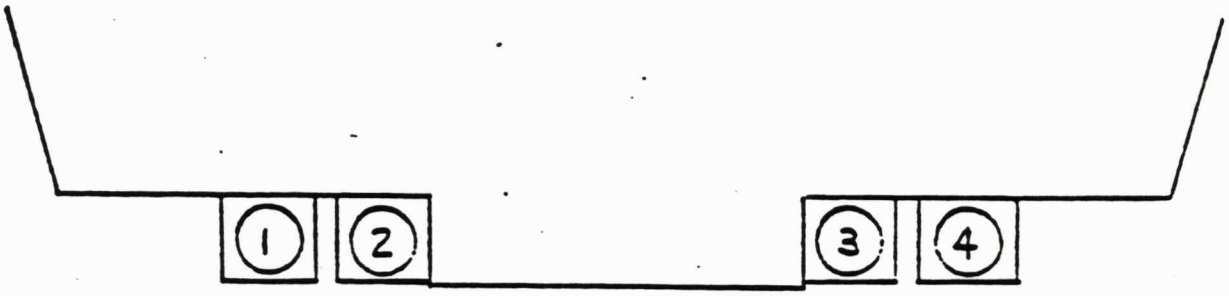
2-3 B-end to B-end 3-3

7.7 Make sure continuity is as indicated <u>ONLY</u>.

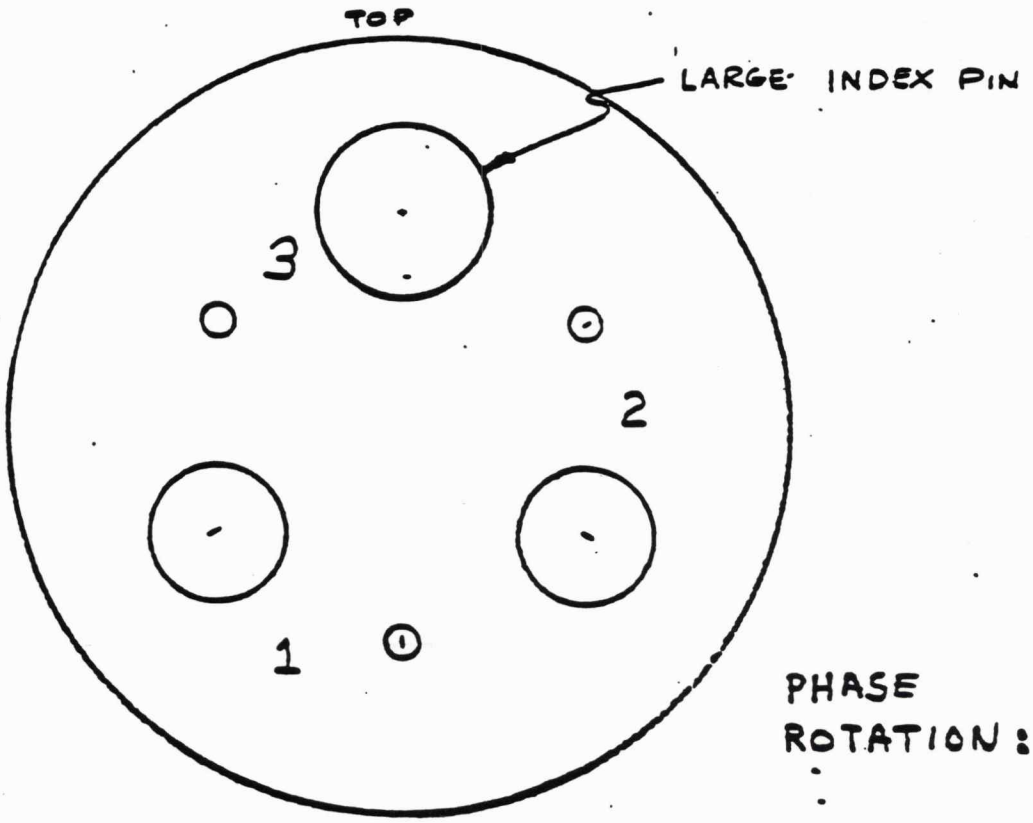
Ring small pin #2 each receptacle to ground all must be 2 ohms or less.

7.8 Megger all pins to ground with 500 volt megger. All must read 3 megs min. with exception of #2 small control pins.

End of Test
Part A



RECEPTACLE NUMBERING
LOOKING AT CAR END FROM OUTSIDE



RECEPTACLE PIN NUMBERS

FIGURE I

480 RECEPTACLE NUMBERING
SK-A-061979 RF BRUSS

SECTION 2.4 TRAINLINE TEST

PART C - 27 POINT TRAINLINE (OHMMETER METHOD)

↖ COMMUNICATIONS

1.0 SCOPE:

The subject test is performed to satisfy the requirements of the Amtrak Specification.

2.0 WHEN USED:

This test is to be performed on each car.

3.0 DEGREE OF CAR CONSTRUCTION:

This procedure is to be applied to the car under test after all carbody wiring and equipment has been installed and connected. The car shall have been successfully tested to Sections 6.1, 6.2, & 6.3. Decelostat and PA Unit must be in place.

4.0 LOCATION OF TEST:

The subject test shall be performed at the carbuilders plant.

5.0 APPLICABLE DOCUMENTS:

Amtrak Drawings -

E-01-1306

6.0 TEST EQUIPMENT:

6.1 Volt-ohm-meter: John Fluke Model 8000 or equivalent.

7.0 PROCEDURE:

7.1 Preliminary: Follow the sequence below.

7.1.2 Remove any 480V, 3Ø, 60 Hz. power source.

7.1.3 Turn off All car circuit breakers.

7.2 Continuity

7.2.1 Ring end to end Table ~~one~~ with an ohmmeter, each wire must read less than 2 ohms.

TABLE 1

A-End	Rings to	B-End	
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
11		11	
12		12	
13		13	
14		15	NOTE WIRES CROSSED
15		14	" " "
16		17	" " "
17		16	" " "
18		23	" " "
19		19	
20		20	
21		21	
22		22	
23		18	NOTE WIRES CROSSED
24		24	
25		25	
26		26	
27		27	

7.2.2 Ring side to side on the A-end of the car. Each wire must read less than 2 ohms.

7.2.3 Ring side to side on the B-end of the car. Each wire must read less than 2 ohms.

7.3.0 Trainline Operation Procedure:

Turn on all DC circuit breakers.

7.3.2 Press the B-end conductor signal button. Number 22 wire should read battery voltage to #2 wire.

7.3.3 Press the A-end conductor signal button. Number 22 wire should read battery voltage to #2 wire.

7.3.4 Press the vestibule conductor signal button. Number 22 wire should read battery voltage to #2 wire.

7.3.5 Loop the 27 point cable on the Aend of the car. Battery voltage should appear at 19, 20, 23, 26 on the A-end and 18, 19, 20, 26 on the B-end.

7.3.6 Remove loop at the A-end of the car. Pins 19, 20, 23, 26 should go dead, on the A-end, and Pins 18, 19, 20, 26 should go dead on the B-end.

7.3.7 Loop the B-end 27 point cable. Pins 19, 20, 23, 26 - B-end and 18, 19, 20, 26 on the A-end, should go live.

7.3.8 Remove loop at the B-end of the car. Pins 19, 20, 23, 26 should go dead, on the B-end, and 18, 19, 20, 26 on the A-end.

End of Test
Part C

SECTION 6.2 MEGGER AND HI-POT TEST

PART A

1.0 SCOPE:

1.1 This test covers the megger and hipotential testing of car wiring.

1.2 Final car megger testing is covered by Section III.

2.0 TEST SEQUENCE:

2.1 Test per Section I shall have been conducted and satisfactorily passed before this test is carried out.

3.0 EQUIPMENT REQUIRED:

3.1 James Biddle "Megger" Model #21159 or equivalent.

3.2 Associated Research Model 4642 MB Power Supply or equivalent.

3.3 Clip leads, shorting wire, special shorting harnesses, blocks, PCB's, as required.

3.4 Storage rack for PCB's. (Printed circuit boards)

3.5 Continuity Tester.

4.0 APPLICABLE DOCUMENTS:

4.1 Amtrak Specification.

5.0 REQUIREMENTS:

5.1 The Hi-pot test shall be performed after the car wiring has been installed and all equipment is connected and mounted, except as detailed in Table 1.

5.2 All wiring that is to be hi-potted shall first be subjected to a successful insulation resistance test.

6.0 PREPARATION:

6.1 Erect safety barriers and notices.

6.2 Disconnect all external power supplies and connections to car.

6.3 Stow body end 480V power jumpers in their receptacles.

6.4 Remove all appliances connected to convenience outlets in car.

6.5 Make the disconnections shown in Table 1.

6.6 Place all switches and circuit breakers into the ON position, including all light switches, room fans, etc.

6.7 Mechanically close all relays and contactors, except TR1, TR2, and TR3.

6.8 Test the continuity of the shorting connections with a suitable continuity checker.

6.9 Apply removable ground (carbody) connections to the following groups of wiring.

6.9.1 480 VAC wiring (480 TL typical)

OPTIONAL

6.9.2 240 VAC (FHTA typical)

6.9.3 208 VAC wiring (typical diner and lounge cafe)

6.9.4 120 VAC wiring ("A" in 64/120 switchboard)

6.9.5 28 VAC (lounge aisle lights only)

6.9.6 VDC Trainline wiring (BB + typical)

7.0 <u>INSULATION RESISTANCE TEST PROCEDURE</u>:

7.1 Measure the insulation resistance of each group of wiring in accordance with the following Table (A) by removing the ground connection shown in column (2) and applying the megger voltage set to the value shown in column (4) to the wiring group shown in column (3).

TABLE (A)
MEGGER TEST

TEST NO. (1)	REMOVE THIS GROUND CONN. (2)	WIRING TO BE TESTED (3)	MEGGER VOLTAGE (4)	MINIMUM RESISTANCE MEG (5)
7.1.1	x	480 VAC	500 V	3
7.1.2	x	480 VAC	500 V	3
7.1.3	x	480 VAC	500 V	3
OPTIONAL 7.1.4	x	120 VAC	500 V	3
7.1.5	x	28 VAC	500 V	2
7.1.6	x	64 VDC & TRAINLINES	500 V	2

x Disconnect carbody ground to this wiring group

7.2 The ground connections shall be removed only for the test in question and shall be re-applied after the test is completed and before the next test is commenced.

7.3 Record the insulation resistance values measured, on the data sheet provided.

7.4 In the event that the insulation resistance measured is less than the minimum acceptable value the following procedure shall apply.

7.4.1 Isolate cause of low insulation resistance by dividing the circuits and retesting the wiring.

7.4.2 Make good the insulation by an approved method and carry out a complete retest, recording the new values in the space provided on the data sheet.

7.4.3 Should the insulation resistance of all the individually divided subcircuits be greater than the minimum acceptable value for the wiring group, then the test shall be considered passed, and a note to this effect placed on the data sheet.

8.0 HIGH POTENTIAL TEST PROCEDURE:

8.1 Carry out a sixty (60) second high-potential test on each group of wiring in accordance with the following Table (B) by removing the ground connection shown in column (2) and applying the test potential shown in column (4) to the wiring group shown in column (3). The trip current shall be set in accordance with column (5).

TABLE (B)
HI-POT TEST

TEST NO. (1)	REMOVE THIS GROUND CONN. (2)	WIRING TO BE TESTED (3)	TEST POTENTIAL (4)	TRIP CURRENT (5)	1st RETEST TEST POTENTIAL (6)	2nd RE TES POTEN (7
8.1.1	x	480 VAC	1670V	10 mA	1420V	121
8.1.2	x	480 VAC	1260V	10 mA	1070V	91
8.1.3	x	480 VAC	1200V	10 mA	1020V	87
8.1.4	x	120 VAC	1100V	10 mA	940V	79
8.1.5	x	28 VAC	900V	10 mA	765V	65
8.1.6	x	64 VDC & TRAINLINES	1000V	10 mA	850V	72

OPTIONAL

x Disconnect carbody ground to this wiring group

8.2 The ground connection shall be removed only for the test in question, and shall be re-applied after the test is completed and before the next test is commenced.

8.3 Record the results of the test on the data sheet provided.

8.4 In the event that the leakage current exceeds the preset trip current for the wiring group being tested, the following procedure shall apply.

8.4.1 Isolate the cause of the failure and make an approved repair.

8.4.2 Carry out an insulation resistance test in accordance with Section 7, on the wiring group affected. If successful proceed to 8.4.3.

8.4.3 Carry out a high-potential retest on all car wiring at the test potential shown in column (6) of Table (B).

8.5 If a second retest is required then the procedure indicated in 8.4 shall be repeated using the retest potentials shown in column (7). Any further retesting shall be carried out at a potential of 85% of the previously applied test potential.

8.6 All retest results shall be recorded on the data sheet.

9.0 COMPLETION:

9.1 Disconnect test equipment and remove temporary ground connections.

9.2 Remove shorting connections, release relays and contactors mechanically closed, and reconnect all car wiring, connectors and ground.

9.3 Replace equipment removed.

9.4 Return circuit breakers and switches to "normal" or "off" positions as appropriate.

9.5 Remove safety barriers and notices.

End of Test
Part A

TABLE 1

EQUIPMENT TO BE DISCONNECTED OR REMOVED

ITEM	EQUIPMENT	WIRES	LOCATION OF DISCONNECTION
1	Battery Cells	B1+, B1-	At Battery
2	Wheelslide Unit		At Carbody Wiring/E5 Wheelslide Unit 2 Connectors - Electric Locker.
3	Battery Charger	BB+, BB-	Undercar
4	Temperature Control Panel		Electric Locker 2 - Plugs
5	Auxilliary Light Panel		Remove wires from TB, leave plug connected
6	Audio Equipment Panel		Audio Locker
7	Inverter Ballasts		At ballast
8	*Solid State Apliances/Controls		

*NOTE: The heater elements of the kitchen appliances should be Meggered, but not Hi Potted.

TABLE 1

MEGGER AND HI-POT TEST D[illegible] CAR NO. ____

CIRCUIT	MEGGER TEST NO.	MIN RES M	TEST RES M	PASS/ FAIL	RETEST RES M	PASS/ FAIL	HI-POT TEST #	TEST VOLTAGE	LEAKAGE TRIP mA	PASS/ FAIL	1ST RETEST VOLT.	PASS/ FAIL	2ND RETEST VOLT.	PASS/ FAIL
480VAC	7.1.1	3					8.1.1	1670	10		1420		1210	
240VAC	7.1.2	3					8.1.2	1260	10		1070		910	
208VAC	7.1.3	3					8.1.3	1200	10		1020		870	
120VAC	7.1.4	3					8.1.4	1100	10		940		790	
28VAC	7.1.5	2					8.1.5	900	10		765		650	
64VDC +T.L.'s	7.1.6	2					8.1.6	1000	10		850		720	

Remarks _____

MEGGER AND HI-POT FAILURE DATA

CIRCUIT	TEST FAILED	MEGGER RESISTANCE	HIPOT TIMES TESTED	HIPOT LENGTH OF TIME	PROBLEM	CORRECTIVE ACTION

TESTED BY:

WITNESSED BY:

Test Spec PQ-79-1
Section 6.2.2 (Former 6.8)
480 Volt Carbody Trainline Cable

April 17, 1979

Level	Revisions Date	Authorized
A	12-1-82	R F Burns
B	3-10-86	R F Burns

Record of Revisions

Rev.	Pages	Changes	Date
A		Rewrote into standard form	12-1-82
B	1	Revised 9400's & 39980's to "used on".	
	4	Changed test voltage step 7.4 to 2000	3-10-86

1. Scope

1.1 Name of Test

480 volt Carbody Trainline Cable Test

1.2 Cars to be Tested

1126- 9411	(Heritage)
9600- 9623	(Gallery)
10000-10003	(Inspection & Training)
10400-10403	(Wheel Car)
20000-28307	(Amfleet)
31000-38038	(Superliner)
39900-39985	(Hi-Level)

1.3 Reason for Test

The check the insulation quality of the 480V trainline cables to detect flaws before cable failure.

1.4 Test Limitations

This test does not test NON-trainline 480V wiring.

2. Timing of Test

2.1 When

This test is to be administered on the 360-day program, any time the car is in backshop, and any time the car has 480 volt cable or receptacle repairs.

2.2 Prequisites for Test

The hi-pot test shall be performed after the car trainline wiring has been inspected and repaired as required. All cleats and all cable protection shall be in place.

All wiring that is to be hi-potted shall first be subjected to a successful insulation resistance test.

2.3 Location of Test

Running repair or backshop facility.

Table of Contents

List of Illustrations

3. Reference Documents

3.1 Manuals

Maintenance manual Chapter 6
Instruction manuals for Megger & Hi-Pot Unit

3.2 Drawings

None

4. Utilities & Test Instruments

4.1 Utilities

120 VAC for high pot instrument

4.2 Test Fixtures

480 Volt Test Plug (Fig. 4)

4.3 Test Instruments

James Biddle "Megger" Model #21159 or equivalent (500 V).

Associated Research Model 5205
DC High Potential Tester Do Not Substitute.

5. Precautions

5.1 Human

5.1.1 Erect safety barriers around car, preventing touching 480 volt receptacles or car wiring.

5.1.2 Do not touch hi-potted wires for 10 minutes after test - they hold a charge.

5.2 Equipment

None

6. Preparation

6.1 Disconnect all external power supplies and connections to car.

6.2 Open the car 480V main circuit breaker.

6.3 Dry the 480V Plugs and Receptacles.

6.4 Stow the body power jumpers into their mating receptacles, and connect the test plug to the A-end left side jumper cable.

7. Test Procedure

This test consists of 3 parts:

A. Initial megger
B. High Potential
C. Final Ground Resistance

7A INSULATION RESISTANCE TEST PROCEDURE:

7.1 Measure the insulation resistance of each group of wiring in accordance with the following Table (A).

TABLE A

Step	Megger Between	Megger Voltage	Min. Reading
1	Power Pin #1 & 2	500 V	3 Meg.
2	Power Pin #2 & 3	500 V	3 Meg.
3	Power Pin #1 & 3	500 V	3 Meg.
4	Power Pin #1 & Carbody	500 V	3 Meg.
5	Power Pin #2 & Carbody	500 V	3 Meg.
6	Power Pin #3 & Carbody	500 V	3 Meg.

7.2 In the event that the insulation resistance measured is less than the minimum acceptable value the following procedure shall apply:

a. Isolate cause of low insulation resistance by dividing the wiring and retesting.

b. Make good the insulation by an approved method and carry out a complete retest, recording the new values in the space provided on the data sheet.

c. Should the insulation resistance of all the individually divided subcircuits be greater than the minimum acceptable value for the wiring group, then the test shall be considered passed, and a note to this effect placed on the data sheet.

7B HIGH POTENTIAL TEST PROCEDURE:

7.1 Connect the high pot testor to the test plug as shown in Fig. 1.

7.2 Set the Hi-Pot tester controls as shown in Fig. 2.

7.3 Turn on the high voltage switch and slowly increase the voltage to the required value. Raise the voltage slowly enough to not violently pin the microamps meter. It will not damage the meter to pin it, but this should be kept to a minimum. Begin the 60 second timing once the microamps meter has nearly stopped moving. Refer to Fig. 3 for meter readings.

7.4 Carry out a sixty (60) second high-potential test on each group of wiring in accordance with the following Table (B). Keep test voltage on for 1 minute.

TABLE (B)
HI-POT TEST

Step	Test Between:	Test Voltage	Max Current (on 200 Micro AMP Range) = 50 Micro Amps Scale Reading:
1	Power Pin #1 & 2	2000	.5
2	Power Pin #2 & 3	2000	.5
3	Power Pin #3 & 1	2000	.5
4	Power Pin #1 & Ground	2000	.5
5	Power Pin #2 & Ground	2000	.5
6	Power Pin #3 & Ground	2000	.5

7.5 Record the results of the test on the data sheet provided.

7.6 In the event that the leakage current exceeds the acceptable current, the following procedure shall apply:

a. Isolate the cause of the failure and make an approved repair.

b. Carry out an insulation resistance test in accordance with Section 7A, on the wiring group affected. If successful proceed to 7B.6c.

c. Carry out a high-potential retest on all car wiring as shown in Table (B).

d. All retest results shall be recorded on that data sheet.

7C FINAL DC GROUND RESISTANCE PROCEDURE:

7.1 Repeat step 7A.1.

7.2 Record these readings on test data sheet.

8. COMPLETION:

8.1 Disconnect test equipment and remove temporary ground connections.

8.2 Turn on car main 480V circuit breaker.

8.3 Remove safety barriers.

End of test Procedure

9. Illustrations

Following 4 pages

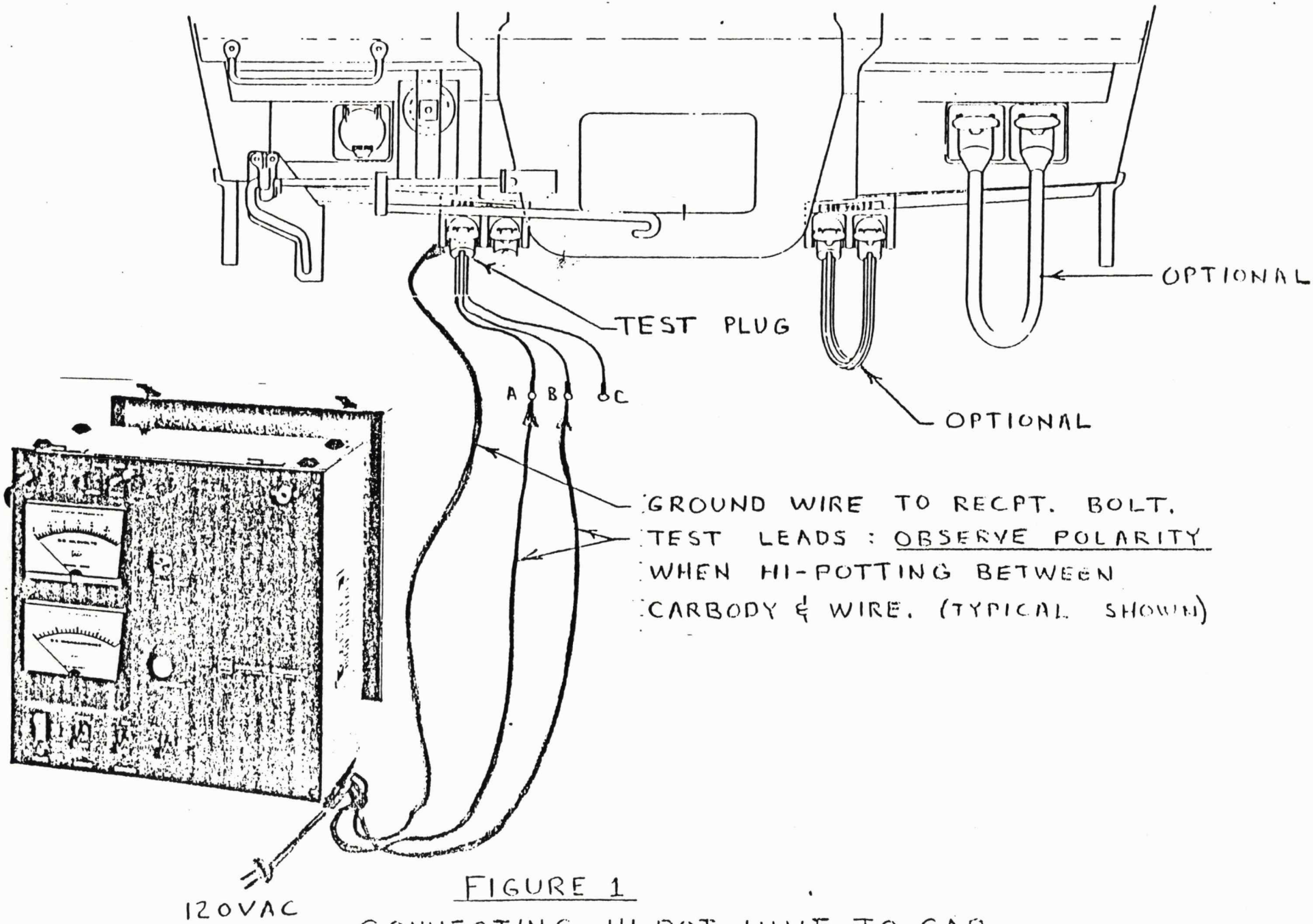


FIGURE 1

CONNECTING HI POT UNIT TO CAR

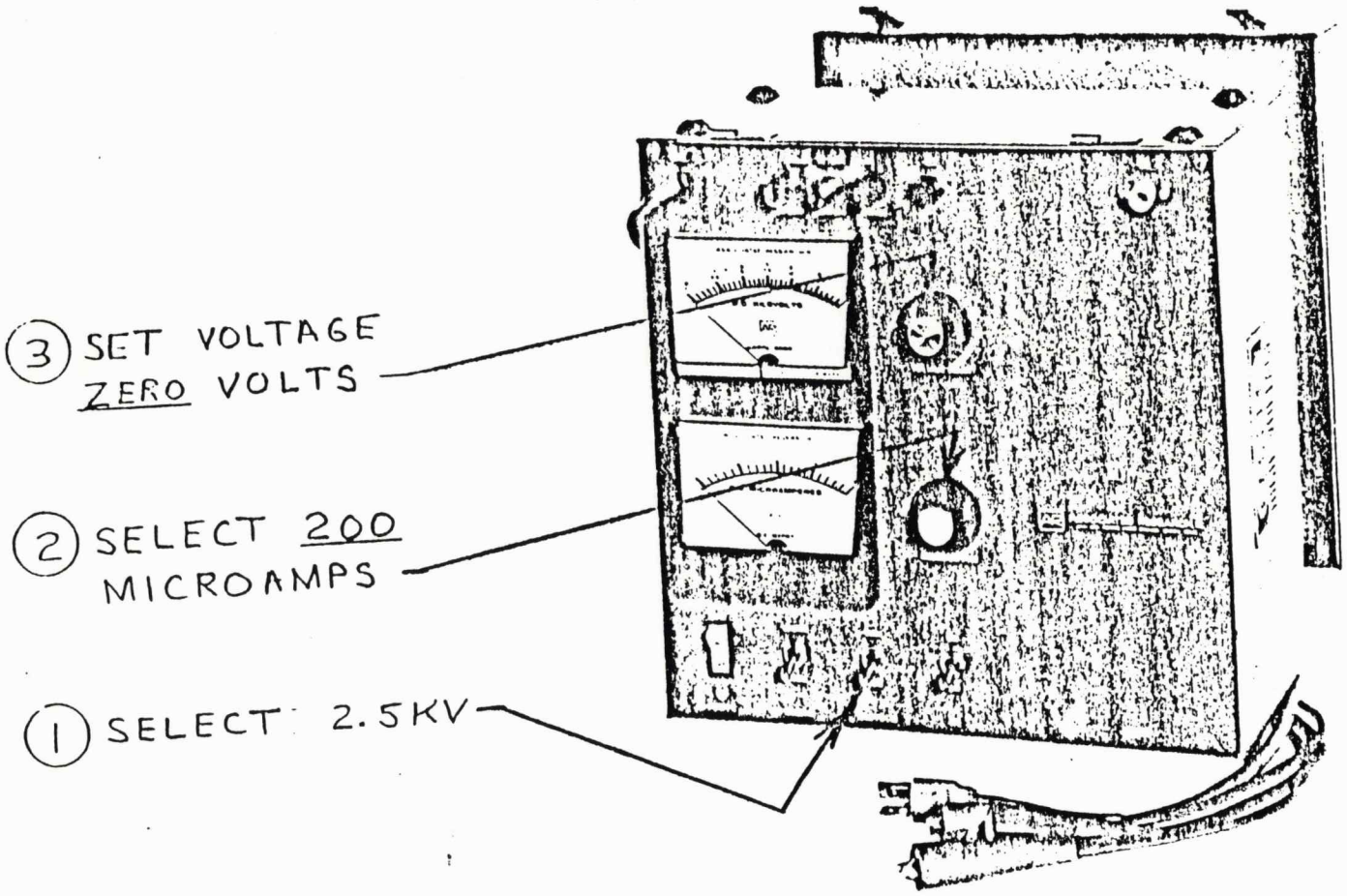


FIG. 2 HIPOT SET UP

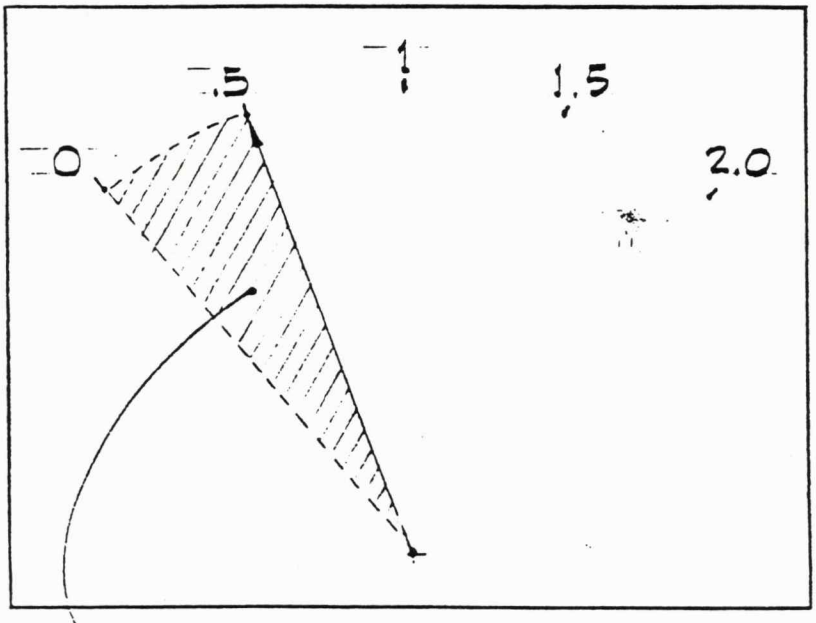
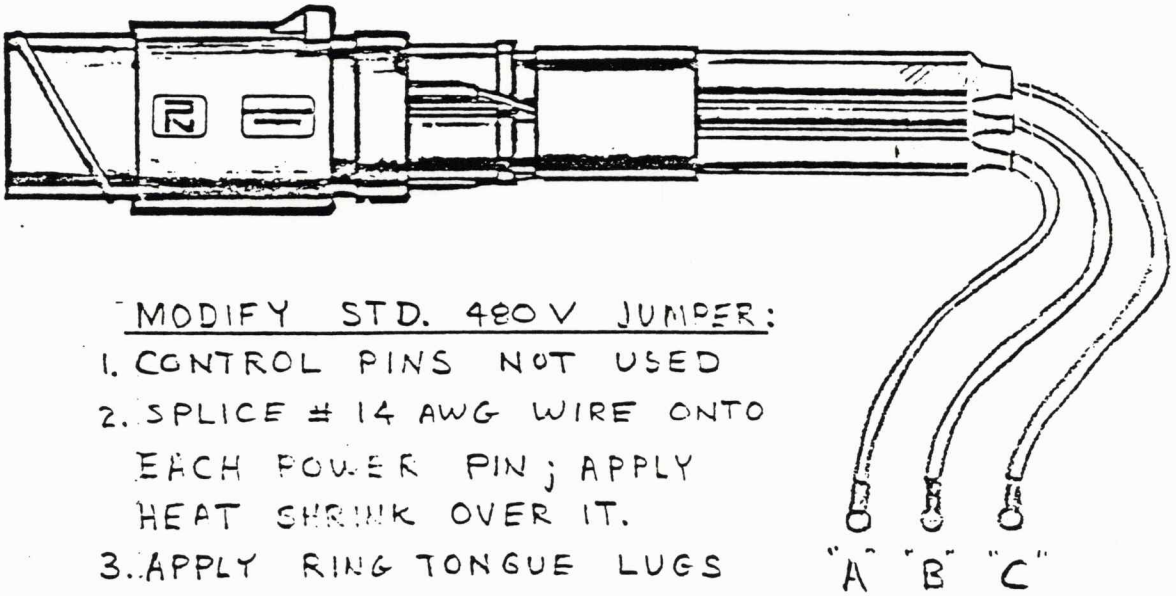


FIGURE 3
METER READINGS



MODIFY STD. 480 V JUMPER:

1. CONTROL PINS NOT USED
2. SPLICE # 14 AWG WIRE ONTO EACH POWER PIN; APPLY HEAT SHRINK OVER IT.
3. APPLY RING TONGUE LUGS TO THESE 3 WIRES.

4 TAG WIRES : PIN 1 = A, 2 = B, 3 = C.

FIGURE 4

480 VOLT TEST PLUG

10. Data Sheet

CAR # _____ DATE _____

Step
7A.1 Megger - Test

	READING (3 meg min.) 1st Try	2nd Try
Power Pin 1 & 2		
Power Pin 2 & 3		
Power Pin 3 & 1		
Power Pin 1 & GRD		
Power Pin 2 & GRD		
Power Pin 3 & GRD		

Comments: _____

7B.4 Hi-Pot Test

	READING (50 Micro AMP MAX .5 on 200 Range) 1st Try	2nd Try
Power Pin 1 & 2		
Power Pin 2 & 3		
Power Pin 3 & 1		
Power Pin 1 & GRD		
Power Pin 2 & GRD		
Power Pin 3 & GRD		

Comments: _____

7C.1 Final DC Ground Test

	READING (3 meg min.) 1st Try	2nd Try
Power Pin 1 & 2		
Power Pin 2 & 3		
Power Pin 3 & 1		
Power Pin 1 & GRD		
Power Pin 2 & GRD		
Power Pin 3 & GRD		

Comments: _____

DONE BY _____

SECTION 10.2 LEVELING OF PASSENGER CARBODIES

1.0 SCOPE:

The following procedure is to be used to make final adjustments in leveling the truck frame and carbody, and in achieving proper carbody, coupler, and truck frame height.

2.0 EQUIPMENT:

1. One eighty-five foot section of tangent, level, track equipped with a pit.

2.1 Four 50 ton jacks.

2.2 AAR Steel Wheel Gage

2.3 Device for measuring coupler height from rail.

2.4 Measuring tape.

2.5 5 ft. steel straight edge.

3.0 PROCEDURE:

In leveling passenger car bodies and four wheel trucks the car should be placed on the wheel pit with level track (if wheel pit is not available select level track) and the following measurements should be made and recorded:

3.1 Height of coupler in relation to rail.

3.2 Height of platform at the four corners of car in relation to rail.

3.3 Check thickness of wheel rim with A.A.R. wheel gauge and wheel diameter.

3.4 Obtain the truck frame height from rail at the four corners. This should be done by removing the pedestal tie bars and placing a straight edge against the finished surface of pedestal for pedestal tie bar. The straight edge should be long enough to project over the top of the rail so measurement can be made between it and rail.

3.5 Measure the equalizer and bolster spring heights.

3.6 Check side bearing clearances.

The following leveling procedures should be followed:

The greatest cause of differences in truck frame heights is due to variations in wheel diameter due to wear and turning which changes the distance from rail to equalizer. This should be compensated for in the thickness of the separate journal box equalizer seats. The Pullman Company and some railroads have available separate equalizer seats for application on top of the journal boxes which are made in increments of 1/2 inch thickness, from 1/2 inch to 1-1/2 inch, to provide for reduction in wheel diameter. Their use will provide 1 inch vertical height adjustment between journal box and underside of equalizer. Adjustment due to differences in wheel diameter should be made at this point.

After the equalizers have been leveled by use of the separate equalizer seats, the truck frame should again be checked for level and the balance of leveling of truck frame should be taken care of by shimming at the top of the several equalizer coil springs. The truck arrangement drawing should be referred to for proper trcuk frame heights. Most new trucks have non-metallic pads and 1/8 inch thick steel wear plates at the top of their equalizer springs with 1/8 inch steel plate being applied between the non-metallic pad and the top of the spring. Care should be taken to restore these. When blocking here the top of the springs should be kept at least 3/8 inches inside of the spring pocket at all times.

Most trucks are originally provided with one or two 1/4 inches steel shims between spring plank and swing hanger bar bearing block for car builder's use in lowering or leveling the car. These shims can be removed or added to, within limits, to help level car body. In performing this operation when jacking against the spring plank, the jack should be placed as close as possible to the swing hanger cross bar to avoid bending the spring plank. In adding shims here, care should be taken so that the clearance between underside of truck frame wheel piece and top of bolster when car is about 1-1/2 inches or 2 inches to prevent wheel piece striking top of bolster when car is in operation. If car leans to one side, as measurements at sides of car will indicate, apply 1/32 inches or 1/16 inches shims to spring plank bearing at low side to level car. Hardwood blocks may be applied to top and bottom of bolster coil springs to raise car height or to compensate for springs that have taken a set. When such blocking is done satisfactory, clearance between top of bolster and underside of wheel piece must again be provided.

If the car height is not entirely corrected by the above shimming, blocking or shims may be applied under the truck center plate if separate center plates are used. The maximum blocking or shimming at this point is dependent upon the height of the retaining flanges on top of truck bolster and good engagement should be provided between it and center

plate. After leveling the trucks and car body, the side bearing clearances should be checked and adjusted as may be necessary.

Bolster and equalizer springs as originally furnished by car builder were designed to suit car weight and desired flexibility. When any springs are replaced, they should be checked to make sure they meet the original requirements.

On cars equipped with G.S.C.C. bolster roll stabilizers, no blocks or shims should be applied at top and bottom of bolster springs, unless a spring has taken a permanent set, nor between swing hanger bottom cross bar and bearing on the underside of stabilizer parts as the vertical distance between the spring seat and the bolster spring seat should be held equal on the sides of truck. This is due to the positive mechanics of the bolster roll stabilizer.

4.0 RESULTS:

After the carbody is leveled, the coupler height should conform to P.C. Rule 5 of the Field Manual of the A.A.R Interchange Rules. The following is taken from the above:

4.1 Passenger carrying cars

(1) Minimum - 34 inches
(2) Preferred - 34 1/2 inches
(3) Maximum - 35 inches

4.2 Non-passenger carrying cars

(1) Empty cars - same as passenger carrying cars
(2) Loaded cars
    (a) Minimum - 32 inches
    (b) Preferred - 32 1/2 inches
    (c) Maximum - 33 inches

4.3 Measurements to be made from top of rail to center face of coupler knuckle.

4.4 Where possible, adjustment of coupler height should be made when the car is empty.

4.5 See paragraph 13, Section E of Freight Rule 16, for correct method of adjusting coupler height.

4.6 The distance from the top of rail to the top of the buffer plate shall be as follows:

HEP modified conventional car 53 ±1/4 inch.
HEP modified bi-level car (39900's) 104 3/8 ±1/4.
Non-HEP modified conventional car 50 1/2 ±1/4.
Non-HEP modified bi-level car (9900's) 98 1/16 ±1/4.

4.7 All clearances between truck components shall be in accordance with the applicable GSI general assembly drawing. The clearances shall apply with the car in the light weight condition.

End of Test

SECTION X

PRIVATE CAR ELECTRICAL LOAD/PHASE BALANCE

TEST SPECIFICATION

PQ-79-1

Section 6.2.6B

Name: Private Car
Electrical Load/Phase Balance

Date: February 18, 1986

REVISIONS

Level	Date	Authorized

RECORD OF REVISIONS

TABLE OF CONTENTS

1. Scope

1.1 Name of Test

Private Car Electrical Load/Phase Balance

1.2 Cars to be Tested

Private cars intending to operate on Amtrak Head End Power.

1.3 Reason for Test

a) To ensure car power demand does not exceed Amtrak guidelines.

b) To ensure car has phase balance on HEP within Amtrak guidelines.

1.4 Test Limitations

N.A.

2. Timing of Test

2.1 When

A. When car is undergoing initial inspection for Amtrak HEP compatibility.

B. When car has changes made to its electrical system which change phase balance or total connected load by more than 3KW.

C. This test should be done every three years. Car must be "IN DATE" to operate on HEP in an Amtrak consist.

2.2 Prerequisites for Test

2.2.1 Current Amtrak Equipment Engineering approved drawings must be on file at Corporate Headquarters.

2.2.2 Car must have passed test PQ-79-1, #6.1.2 "Megger."

2.3 Location of Test

Any major Amtrak facility as designated by Corporate Mechanical Department.

3. Reference Documents

3.1 Manuals

N/A

3.2 Drawings

Current Amtrak Equipment Engineering approved single-line schematic of car.

4. Utilities and Test Instruments

4.1 Utilities

480V HEP Yard Power (or locomotive)

4.2 Test Fixtures

N/A

4.3 Test Instruments

Clamp on Ammeter - Amprobe # ACD-2, RS3 or equal

5. Precautions

5.1 Human

Use particular care around car electrical system; car may not follow Amtrak standards.

5.2 Equipment

N/A

6. Preparation

6.1 Inspect car HEP system for:

a) Good general electrical practice; deficiencies must be corrected.

b) Defects; inspect all systems operating on 480V trainline power, including;

1. Trainline receptacles and plugs.
2. Trainline cable and cleats.
3. 480V Junction box.
4. 480V Circuit Breaker Panel.
5. 480V Transformers.
6. Any other 480V loads.

6.2 Check that car conforms to drawings - are all existing car loads included on the drawing? Are the load charts up to date and correct?

7. Test Procedure

7.1 Using the supplied drawings and load charts, measure car power consumption as follows, and record it on the data sheet.

7.2 Turn on all car loads which can be on simultaneously. Note this is not limited to "normal car operation", but by what can realistically be on. For example, it is not realistic to expect heating and A/C on together, but it is reasonable to expect full heat or A/C load with all lighting on and full kitchen load. Create the worst load so available.

7.3 Read the load current on each phase of each 480V load and record on the data sheet. Compare measured values with load chart; if there are inconsistences, determine why. In taking the reading ensure the load is not artificially low by something cycling off, such as a water heater, oven element, etc.

7.3 Measure and record the load current on the main 480V circuit breaker.

8. Completion

8.1 Perform the following calculations to determine if the car meets Amtrak requirements:

a. Max load of 85 KW
b. Max phase imbalance of 5%

Use formula on the data sheet and record results.

8.2 When calculations are completed, make a copy for the car owner, to stay on the car. Send the other copy to Supt. Car Maintenance, Mechanical Department, in Washington, DC.

9.0 Illustration

None

Data Sheet (Test 6.2.6B)

Car No.: _____ Car Name _____

Date: _____ Done By: _____

Location: _____ Witnessed By: _____

Reference #		Check
2.2.2	Car has passed megger test, PQ-79-1, 6.1.2	____
6.1a	Car is wired according to good general electrical practice	____
6.1b	Car has no electrical defects in the following 480V systems:	____
	1. Trainline receptacles and plugs	____
	2. Trainline cable and cleats	____
	3. 480V Junction Box	____
	4. 480V Circuit Breaker Panel	____
	5. 480V Transformer	____
	6. All other 480V loads	____
6.2	Car conforms to drawings and load charts	____
7.3	480V Loads:	

Name	PHASE CURRENTS A	B	C
Main 480V Breaker	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
	:	:	
Total	:	:	

(Continue as required)

Data Sheet (cont'd)

8.1.1 Maximum Car Load

Main breaker current (A+B+C) x 277

Total ØA _____ + ØB _____ + ØC _____ x ____ = _____ kw
(must be less than, or equal to 85 kw)

8.1.2 Phase Balance (at maximum 480V load)

Total (ØA ____ + ØB _____ + ØC _____) ÷ 3

Average Phase current = _____

Obtain the greatest difference between the average and the 3 phase currents. This number must not exceed 5% of the total current.

Maximum difference _____

5 % of total = _____

MCHSP.282

SECTION XI

MISCELLANEOUS

Figure 6.11
480 VOLT UNDERCAR COMPONENTS

ITEM	QTY	DESCRIPTION	MFG	MFG #	AMT #	AMMS #
1	4	480V Receptacle Housing	Pyle National / Anderson			
2	4	480V Receptacle Insert, 24" Pigtail	↓			
3	1	480V Junction Box				
4	--	Cable, 4/0 600V Exane or AAR 591				
5	--	Cable Cleat	Ure			
6	2ea	Elastic Stop Nut				
7	2ea	Bolt				
8	24	Lug 4/0	Amp	326803		
9	2ea	Bolt, Hex Head, 3/8 - 16 x 1" Steel Cadmium Plated				
10	2ea	Locknut, Esna Hex, 3/8 - 16 Steel Cadmium Plated				
11	24	Insulating Sleeve with Clamps	Mark Equipment	M-105-A		
12	24	Lug, #10 AWG Barrel Splice	AMP	320570		
13	4	480V Fixed Jumper, 85"	Pyle National / Anderson			

6.1.5 Ground Straps

Many electrical devices are equipped with ground straps to prevent the possibility of electrical shock. It is very important that all motors, compressors, water heaters and food service appliances be grounded to the carbody through a firm electrical connection. Make certain that the carbody ground is really that - not something which looks to be grounded and is not. For example, the water cooler should not be grounded to the floor (it is plywood on most cars), but rather a piece of car structure, such as a side post.

Grounding is an important safety feature, because the case of a non-grounded electrical device can go to line voltage if there is an insulation failure. The circuit breaker may not trip, either, because an excessive current may not be present. The faulty device may operate for months with this condition, waiting for someone to touch it.

A good safety rule is to assume that the case of something is live unless proven safe. When beginning work on a device which could be live, first tap it with one finger. Thus if it is live, the shock will be brief and not severe (as opposed to grabbing it solidly). If there is no shock, the device can be grabbed with relative safety.

6.1.6 Electrical Tape and Heat Shrink Tubing

Several types of electrical tape and heat shrink tubing are used throughout the cars. Refer to figure 6.8. Adhesive heat shrink tubing is used to produce water proof connections, important where corosion is possible. The minimum shrink size of heat shrink tubing is about 1/2 of the unshrunk size.

6.1.7 Ty-Raps and Clamps

The ty-raps used to secure wire and cable as well as cable clamps are given in figure 6.9. In using ty-raps, avoid, where possible, installations where the strap must support weight.

6.1.8 Cleaning Materials

In cleaning electrical components, especially contacts, care must be used to use materials which will not cause future problems. See figure 6.10.

NOTE: Before filing contactor or relay contacts, refer to manufacturer's instructions first. Many contacts are coated with a thin metal film, and filing will remove it and cause contact destruction. Refer to figure 6.43-6.45.

..2 480 Volt Main Power Distribution and Cable System

480 Volt AC, 3 Phase, 60 Hertz power as supplied directly from the locomotive is used to provide power for the lighting, air conditioning, heating, and the battery charging.

The power trainline is made up of four sets of cables. Each set consists of three 4/0 cables for the 480 Volt circuits. The cables run the full length of the car, terminating in four receptacles at each end of the car. See figure 6.11.

Four jumper cables are used across each car to car or car to locomotive coupling for transmission of power. Refer to Chapter 2.6. On the rear of the last car, adjacent receptacles are also connected together. Known as looping, this protects the live 480 pins and establishes part of the 480V control circuit.

A 3 conductor control cable is used in conjunction with each 480V cable set. Each cable carries one circuit to a common ground on each end of the car, a 2nd circuit safety loop (future use) and the 3rd is a loop circuit from the locomotive through the consist back to the locomotive which controls the 480 Volt power circuit. All intercar and end car jumper cables must be connected before 480 V power can be supplied to the consist. For tests, refer to test spec. PC-79-1, Tests 2.3, 2.7 and 2.8.

6.2.1 480 V Receptacles

Four 480 Volt Receptacles are provided at each end of each car (figure 6.12). The cover of each receptacle is spring loaded closed for two purposes:

1. To hold the inserted jumper cable in place, and
2. To close the cover when no jumper is inserted.

NOTE: Whenever one 480 V receptacle on the car is live, all are live.

The six receptacle pins should be kept clean and dry. If dirty, the receptacle may burn, or the control circuit open and cause a power outage. The pins can be cleaned with the solvent listed in figure 6.10. The caps and cap springs must be kept in good condition, or the 480 jumper cables can work out on the road.

Figure 6.13 details the splice between the 480 receptacle and the car wire. When this splice is made, make certain the cables are secured so they will not abrade, and that they will not interfere with truck or coupler motion.

6.2.2 480 Volt Junction Box

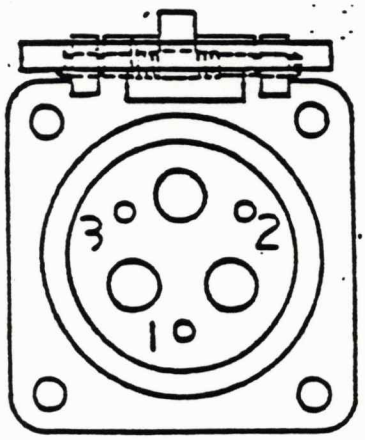
The 4 cable sets of 480 cables from each end of the car meet at the 480 Junction box, figure 6.14. Inside the cables of each phase attach to a common bus bar. This causes load sharing between each of the 4 receptacles and cables on each end of the car as well as providing a point from which to tap off car power to the main 480 breaker.

6.2.3 480 Cables and Cleats

The 480 trainline cables are composed of 4 three phase sets, each of 4/0 wire. Over the trucks, the cables are protected from impact by heavy wall conduit.

The cables are supported by cable cleats at approximately 4 foot intervals. Care must be taken not overtighten the cleat bolt and crush the cables, as insulation failure can result.

FIGURE 6.12
480V RECEPTACLE



TORQUE BOLTS TO:

1/4-20	6 FT LBS
5/16-18	11 FT LBS
3/8-16	19 FT LBS
1/2-13	45 FT LBS

FIGURE 6.13
480V RECEPTACLE PIGTAIL SPLICE

NOTE: ESNA NUTS SHOULD ONLY BE USED TWICE; OTHERWISE THEY MAY WORK LOOSE.

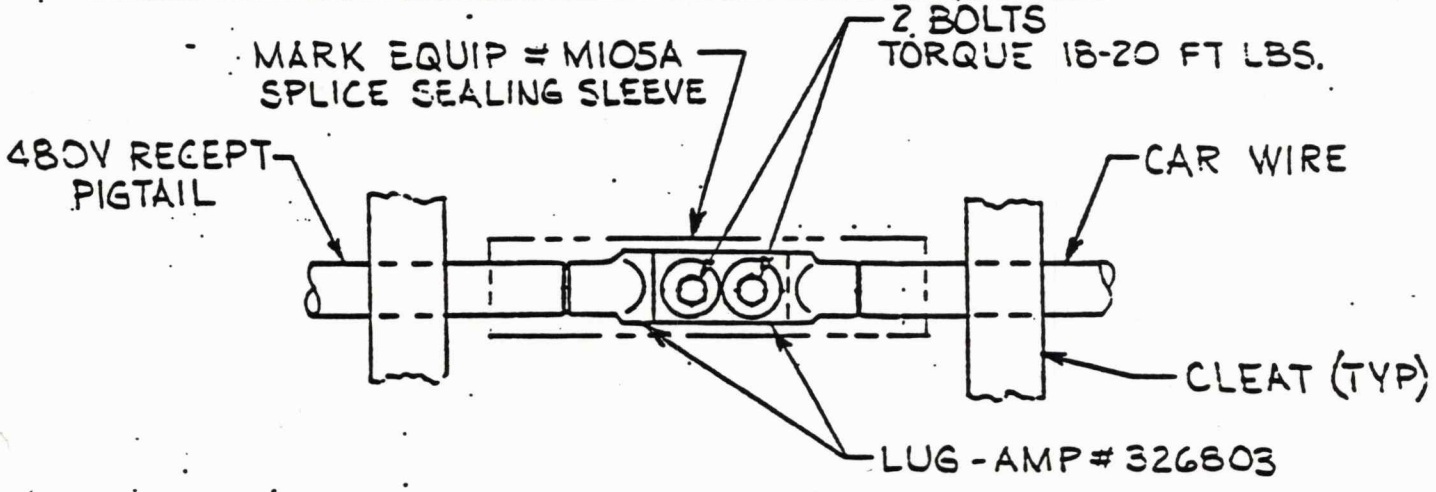
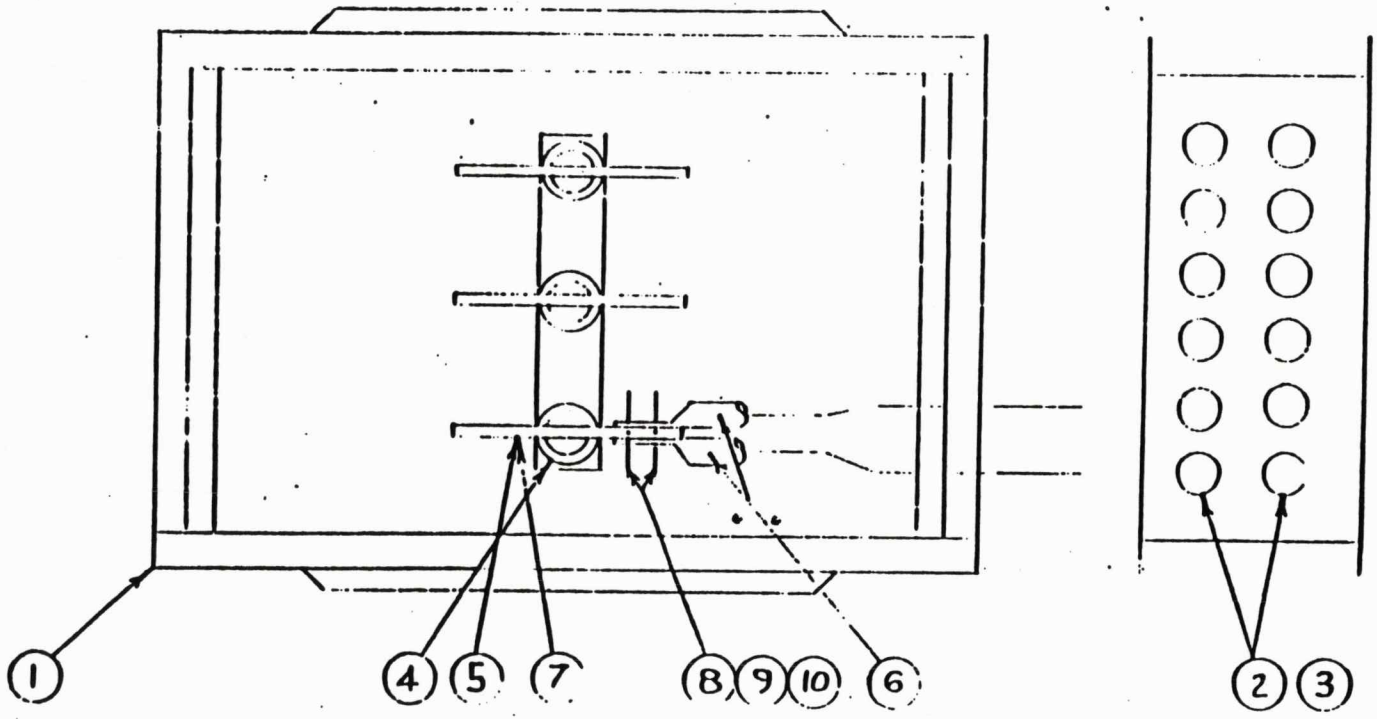


Figure 6.14
480 VOLT J-BOX



ITEM	QTY	DESCRIPTION	MFG	MFG #	ANN #	AWIS #
1	1	480V Junction Box Complete	Beech Grove	[illegible]	---	
2	24	Strain Relief Bushing, Aluminum .687/.812 (EXANE)	Pyle National	DD1413	23X6005958	
3	24	End Bushing, Insulated 1"	Thomas & Betts	1224		
4	3	Support, T Bar Conductor	Reel Seal Electric	88778887	25X9008579	
5	3	Bus Bar, Copper 2 1/2 x 3/8 x	--		25E9008600	
6	24	Lug, 4/0 .23 MCM Wire	Amp	326803	25K4000441	
7	3	Lug, 1/0 Wire	Amp	36917	49A9000218	
8	27	Bolt 3/8 - 16 x 1 1/2 Hex Grade 5 Steel Cadmium Plated	--			
9	27	Nut 3/8 - 16 Lock Nut Grade 5 Steel Cadmium Plated				
10	27	Lock Washer 3/8" Cadmium Plated				

6.2.4 480 Cable Repair Procedures

1. Scope

This specification covers the procedures for repair of External power cables on Head End power equipment, namely the 480 Volt exposed power trainline integral to car wiring to this specification and the 480 Volt power jumpers.

Splicing of the car power jumper is not permitted. Insulation repair will be acceptable when done in accordance with these procedures.

2. Material and Tools Required

Refer to figure 6.18.

3. Extent of Damage Determination

Inspect damaged cable area and determine method of repair required. Refer to figure 6.15.

Type A Repair: Insulation damage and limited conductor only. Length of individual repair is not limited, but must meet the following conditions:

1) No more than 30 inches of repair sleeve is allowed in any 10 feet (25%) of exposed cable.

2) No insulation repairs allowed inside conduit.

3) No insulation repairs allowed within one foot of 480 volt junction box.

4) If proposed repair violates above, use Type C Repair.

Type B Repair: Excessive Damage to Conductor

If conductor damage exceeds that allowed in figure 6.15, the cable must be cut and spliced. Depending upon available slack in cable and length of damage, a single splice, or a short piece of new cable with 2 splices must be used. Repair must meet the following conditions:

1. No more than 5 splices allowed in car length run of a single wire.

2. No splices allowed inside conduit or J-box.

3. No splice repairs allowed within 10 feet of end of car.

4. No splice repairs allowed within 5 feet of 480 volt junction box.

5. No splice repairs allowed in an area with sharp curves in the cable.

6. If proposed repair violates above, use Type "C" repair.

Type C Repair: Excessive Previous Repairs to Cable

If proposed repair violates restrictions on the number of patches or splices given above, that piece of cable is to be cut out and replaced so that the restrictions are obeyed.

4. Repair Procedures

Type A Repair: Insulation Repair Procedure (figure 6.16)

Step 1 Select size of Raychem repair sleeve for particular cable being repaired.

Use:

JRS-200-G-00	For Trainline:	Car Wire
JRS-200-G-00	For Pigtail:	Control Cable
JRS-400-G-00	For Pigtail:	480V Power

Step 2 Cut selected sleeving so that it extends a minimum of 1½" beyond sides of exposed cable area. (Refer to Figure 6.16.)

Step 3 Clean and dry cable of all oil, grease, dirt and water.

Step 4 Wrap sleeving around exposed cable area. The area to be sealed is to be preheated with a torch before sleeve is applied.

Step 5 Close and lock sleeve wrapping with slide-on channel lock.

Step 6 Shrink entire length of sleeve wrapping with standard propane torch or heat gun.

Step 7 NOTE: As heat is applied the heat sensitive paint changes in color from blue to brown. This indicates that shrinkage is complete, the adhesive has fully melted and the sleeve is permanently bonded to the cable.

Step 8 After sufficient cooling time, carefully cut away channel lock from cable. Cut as close to sleeve as possible.

Step 9 Tape ends of wrapping making a smooth joint with the original cable insulation to seal ends.

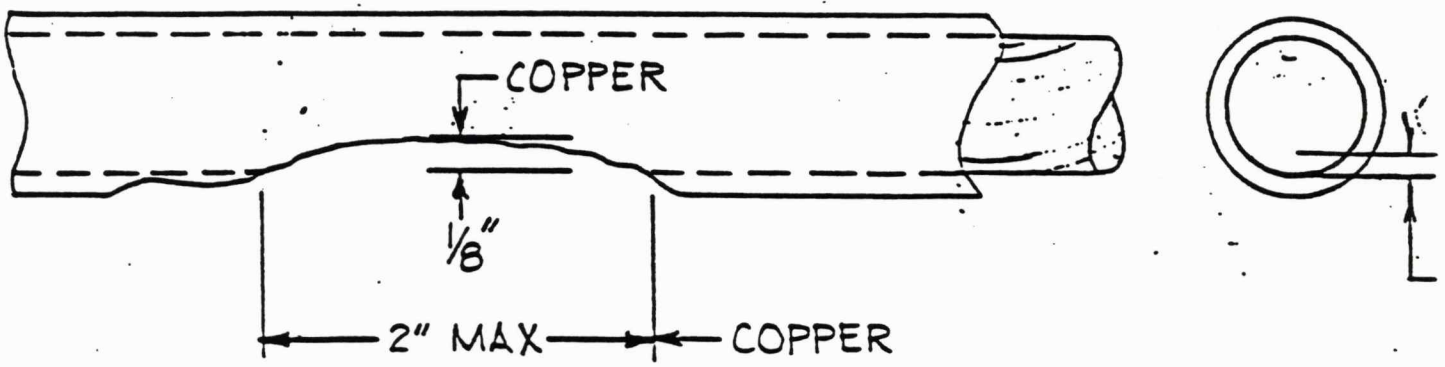


FIGURE 6.15
MAXIMUM ALLOWABLE CONDUCTOR DAMAGE TYPE-A REPAIR

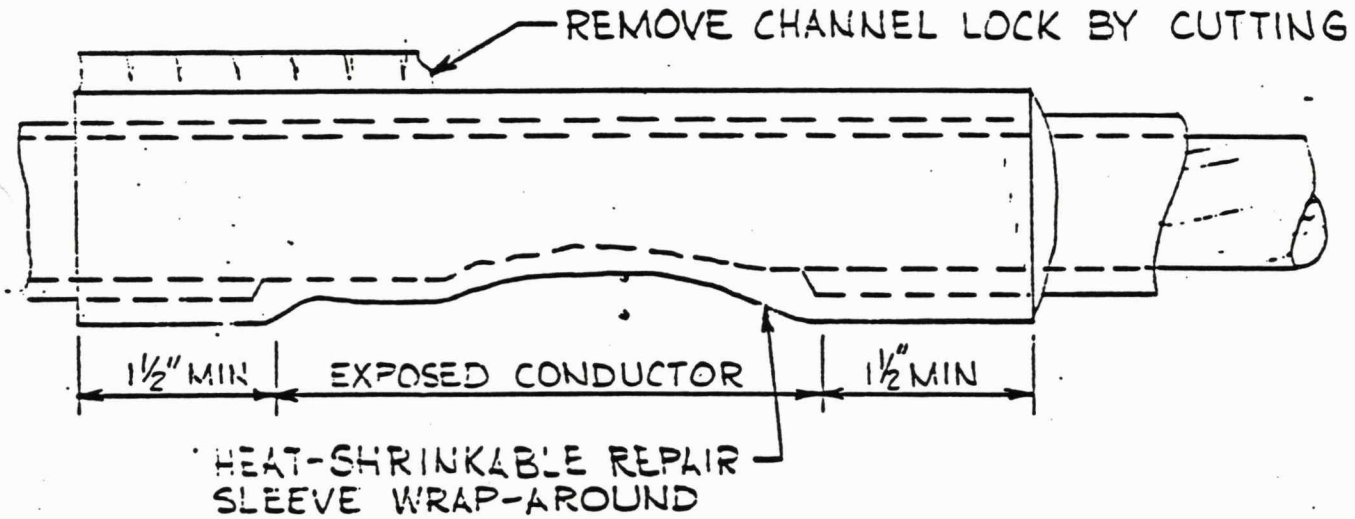


FIGURE 6.16
TYPE B & C REPAIR

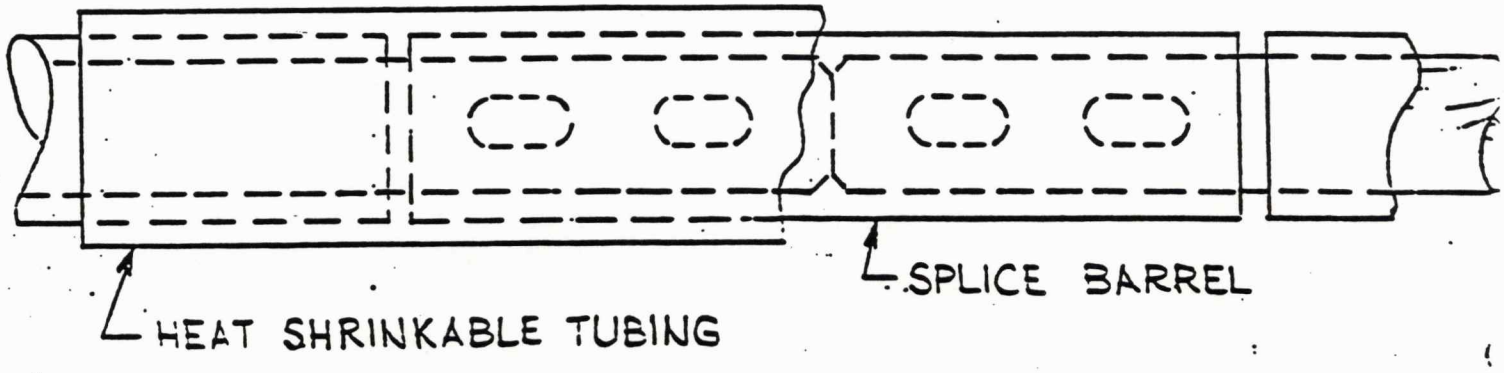


Figure 6.18
400 VOLT CABLE REPAIR PARTS

ITEM	QTY.	DESCRIPTION	MFG	MFG #	AMF #	AMMS #
1	--	Heat Shrinkable Jacket Repair, Sleeve .40 - .80" with clip	Raychem	JRS-200-G-00		
2		Heat Shrinkable Jacket Repair, Sleeve .75 - 1.80" with clip	Raychem	JRS-400-G-00		
3		Heat Shrinkable Sleeve	Burndy	RYA31-2		
4		Electrical Tape	3M	17 or 88	49A9000421	
5		Barrel Splice, Long 4/0	Burndy	YS30		
6		Hydraulic Hand Crimping Tool	Burndy	Y39		
7		Nest Die	Burndy	U30D-1		
8		Indentor Die	Burndy	Y34PR-5		
9		Adapter	Burndy	Y35P3		
10		Hot Air Gun	Alpha	HG-1		

Type B or C: Splice Repair Procedure (figure 6.17)

Step 1 Cut through cable where wire is exposed (cut cable section out if badly damaged, remove damaged section and add additional piece of cable using 2 splices if slack is not available).

Step 2 Clean and dry cable of all oil, grease, dirt and water.

Step 3 Cut sleeving Burndy #RYA31-2 length of 9" to cover cable splice, apply over cable prior to splicing.

*Step 4 Strip 2-1/8" of insulation from cables where joint is to be made.

Step 5 Insert cable end into Burndy #YS30 long barrel splice.

Step 6 Using Burndy #Y39 hydraulic press with #U30D-1 Nest Die, #Y34PR-5 Indentor Die and #Y35P3 Adapter Die, crimp end of long barrel splice with press two times. Check to make sure of tight crimp. Refer to figure 6.17.

Step 7 Insert other cable end into #YS30 long barrel splice.

Step 8 Repeat Step 6.

Step 9 Slide sleeving around exposed connector.

Step 10 Shrink entire length of sleeve wrapping with standard torch or heat gun.

Step 11 Tape ends of wrapping making smooth joint with original cable insulation to seal ends.

5. Tests

No tests are specifically required after a cable repair, however if insulation problems are suspected, do test 6.8 of Test Spec PQ-79-1.

6.3 27 Point Trainline Circuits

A 27-conductor cable system runs the length of the train. Also known as the communications cable, it contains tape music, PA, intercom, radio, door controls, brake applied and released lights and conductor signal circuits.

Each car is provided with 4 - 27 point receptacles, 2 per car end. The cover is painted blue and identified as "CAR CNT". See figure 6.19.

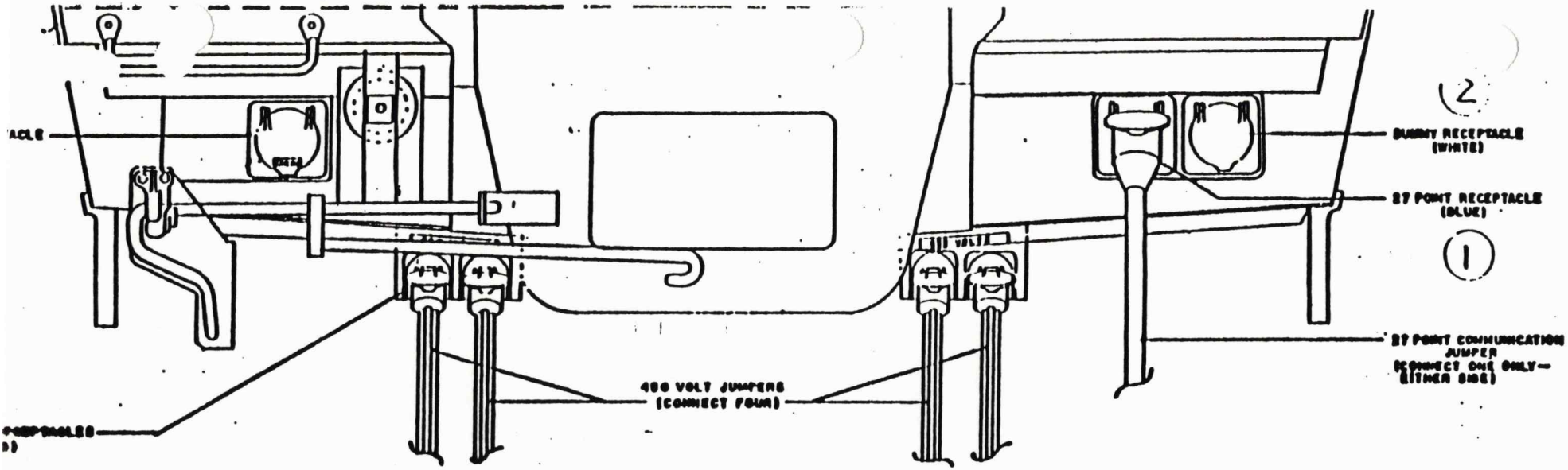
Car-to-car connection is via a single jumper cable, which can be connected to either side of the car. Refer to chapter 2.6 for procedure.

A dummy receptacle, painted white, is also provided on one side of the car. The jumper must be inserted into the blue receptacle and adjacent white receptacle at the end of the train. This activates the loop relay at that point, on the rear, providing power for the locomotive door closed, brake applied and released light trainlines.

Figure 6.20 gives the function of each wire of the communications cable system. Note that many of the wires merely run through the car without connecting to any car equipment; they are, however, required for Amfleet and Superliner cars.

Connections between the receptacle pigtails and car wiring are made in a 27 point junction box, located underneath each end of the car.

For tests of the communications system, refer to test spec. PO-79-1 tests 2.4 and 2.9



TRAINLINE JUMPER ARRANGEMENT BETWEEN CARS, OR CARS AND LOCOMOTIVE

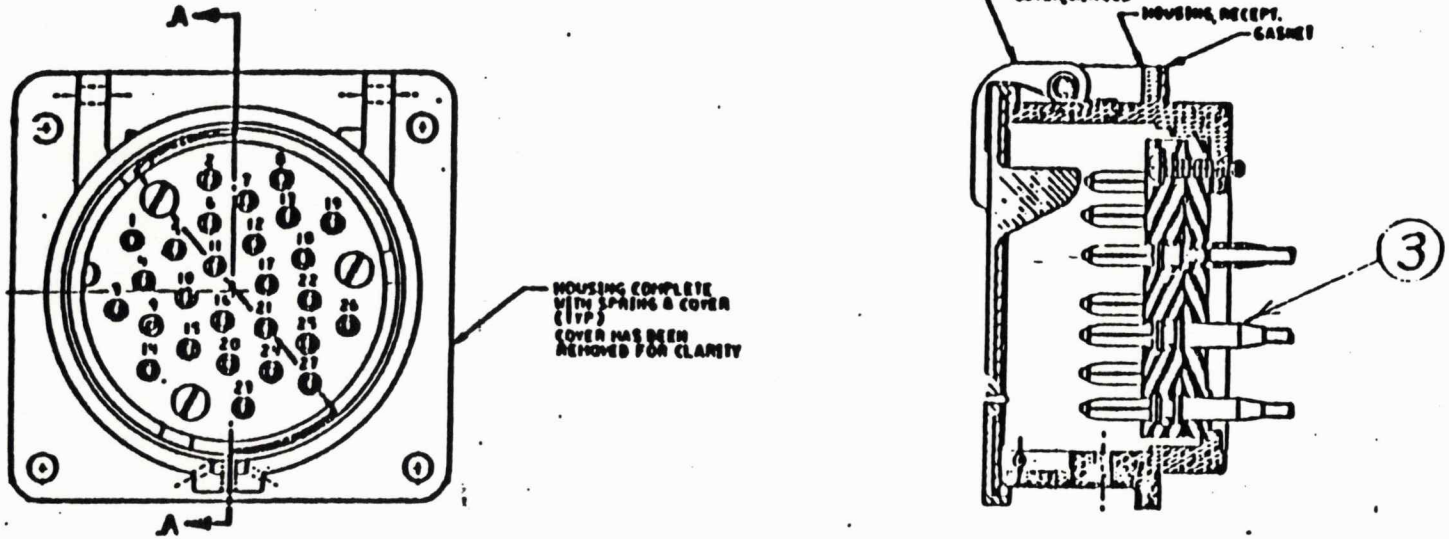


FIGURE 6.19

27 POINT TRAINLINE CONNECTIONS

Figure 6.19
27 POINT RECEPTACLE PART LIST

ITEM	QTY	DESCRIPTION	MFG	MFG #	AMT #	ANDS #
1		27 Point Communication Receptacle w/180" Leads	Pyle-National	WHRF-27 MITR-L-180	25A4000077	
2		27 Point Communication Receptacle, Dummy, 180" Leads	Pyle-National	WHRF-27 MITR-XL-180	25A4000079	
3		Cover	Pyle-National	WHR5	23D4001300	
4		Spring, Cover	Pyle-National	WHR7A	12H4000529	
5		Pin, Electrical	Pyle-National	14017BSTZ	11X4000527	
6		Gasket	Pyle-National	ECS405	23X4001301	

Wire Functions, 27 Point Cable
Figure 6.20

PIN #	SYMBOL	FUNCTION
1	SHLD	PA Wire Shield
2	TB--	Battery Negative (Car)
3	PA1	Tape Music No. 1
4	PA2	Tape Music No. 1
5	PA3	PA & Intercom
6	PA4	PA & Intercom
7	PA5	PA Control
8	PA6	PA Control
9	RA1	Radio (Future Use)
10	RA2	Radio (Future Use)
11	EP1	Brake Application
12	EP2	Brake Release
13	EP3	Brake Negative
14	D1	Door Control - Right Open
15	D2	Door Control - Left Open
16	D3	Door Control - Right Close
17	D4	Door Control - Left Close
18	DC1	Engineman's Door Close Light
19	BR	Engineman's Brake Release Light
20	BA	Engineman's Brake Applied Light
21	HJ	Hot Journal Box
22	CS	Conductor's Signal
23	DC2	Conductor's Door Close Light
24	PA7	Tape Music No. 2 (future)
25	PA8	Tape Music No. 2 (future)
26	BLS	Conductor's Door Close Light
27	AN	Attendant Call (future)

2.6.1 Power Trainlines - 480 Volt

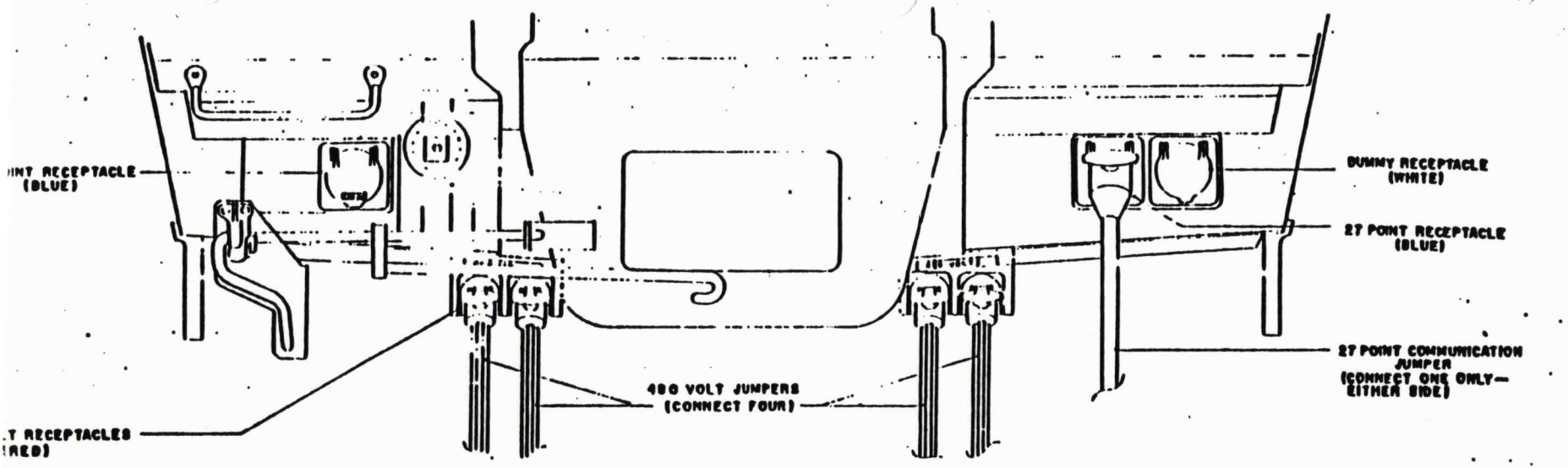
These cars are equipped with a 480 volt trainline jumper system, for transmitting 480 volt, 3-phase power from locomotive or yard power throughout the train. Four red "480 volt" receptacles are provided at each end of each car for these connections. All four jumpers must be used across each car-to-car, locomotive-to-locomotive and locomotive-to-car coupling. This is required for safety as well as the current capacity. See figures 2.36-2.37 for cabling details.

These cars are equipped with an interlock circuit that requires that all jumpers between cars be connected; plus, on the last car of a train, each of the two adjacent receptacles must be interconnected with jumpers in order that the 480 Volt trainline becomes energized. If any one of the 480 Volt jumpers is disconnected, the power to all cars will be shut off. When making up a train to the locomotive with 480 jumper cables, once all cables are secure in the receptacles, the Green "trainline complete" light on the locomotive HEP controls should light. (FL-9, E-60 and AEM-7 locomotives have one trainline complete light for each side of the train; both must be on for the system supply power to the train.) Until this circuit is complete, HEP cannot be applied to the train. All four 480 Volt jumpers must be connected before power is applied.

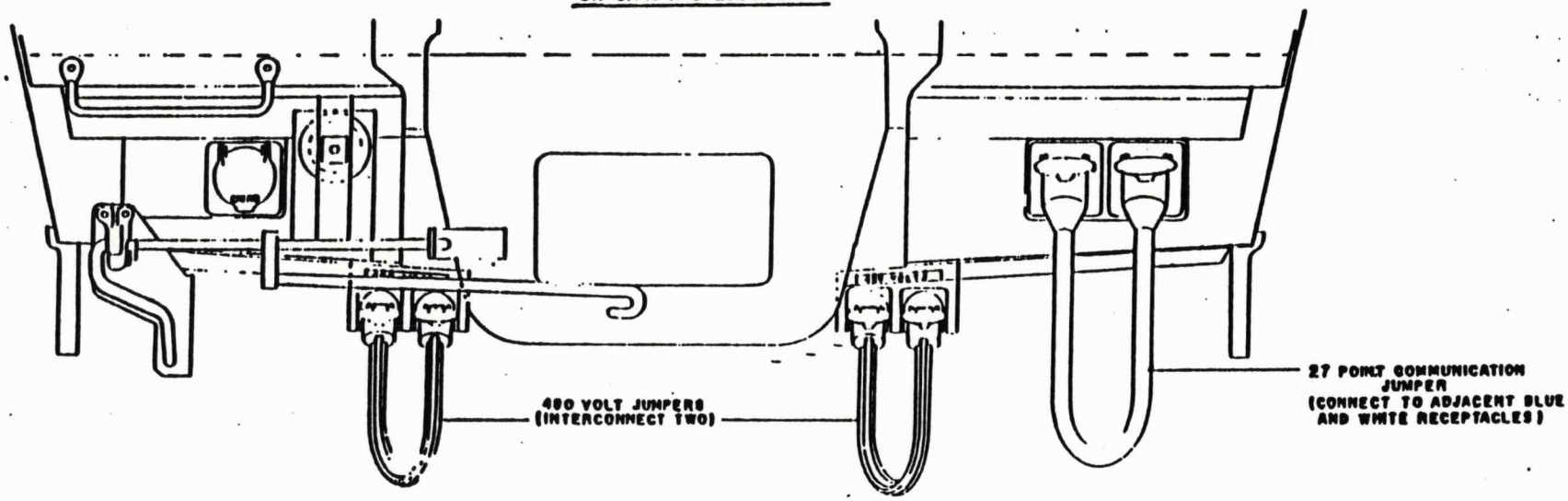
NOTE: When disconnecting any 480 jumpers, make sure the 480 power is turned off at the Source before attempting to remove the cables. DO NOT RELY ON THE LOOP CIRCUIT TO TURN OFF THE POWER FOR YOU. It must be turned off manually. Refer to fig. 2.35.

NOTE: If any of the 8-480 volt receptacles are live, all 8 are live. Never insert any metallic objects, hands, etc. into any of these receptacles unless you know for a fact all power is off on that car. Don't trust, Check.

NOTE: "Short Looping" is a very dangerous practice. Not only is it then possible to overload a pair of cables, but the safety features of the loop circuit are then bypassed, inviting accidents.



TRAINLINE JUMPER ARRANGEMENT BETWEEN CARS,
OR CARS AND LOCOMOTIVE



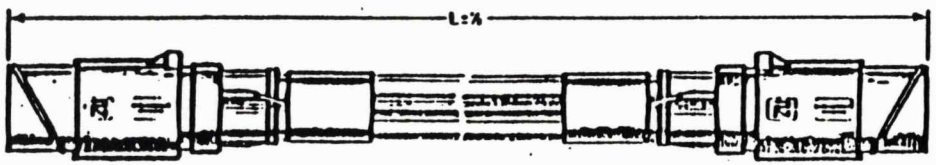
TRAINLINE JUMPER ARRANGEMENT AT END OF TRAIN

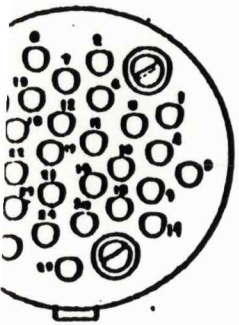
FIGURE 2.30 TRAINLINE CONNECTIONS

Figure 2.31
ELECTRICAL JUMPER CABLE PART LIST

M	QTY	DESCRIPTION	MFG	MFG #	AMT #	AMIS #
		480 Volt Power Jumper 51" (Car to Car)	Pyle National	RPC-10-51	25A4000083	
		480 Volt Power Jumper 84" (Loco to Car & Loco to Loco)	Pyle National	RPC-10-84	25A4000081	
1		480 Volt Power Jumper 10' (Loco to Loco)	Pyle National	RPC-10-120	25T4013851	
1		480 Volt Power Jumper 25' Yard Standby	Pyle National	RPC-10-300	25A4000186	
5		480 Volt Power Junper 50' Yard Standby	Pyle National	RPC-10-600	25X9010245	
5		480 Volt Power Jumper 100' Yard Standby	Pyle National	RPC-10-1200	25A4000269	
7		27 Point Communication Jumper 60" (Car to Car)	Pyle National	WHPCJ 2746 AMTR	25A4000217	
8		27 Point Communication Jumper 71" (Loco to Car Loco to Loco)	Pyle National	WHPCJ 2757 AMTRLO	25A4000076	
9		Battery Trainline Jumper 50"	Pyle National	TLPJ-21050		
0		Ring, Rubber for Item #9, 3 3/4 OD x 3/8	Pyle National	TPR-15		

TE: 480 Volt Cable Length includes entire plug.





G END DETAIL

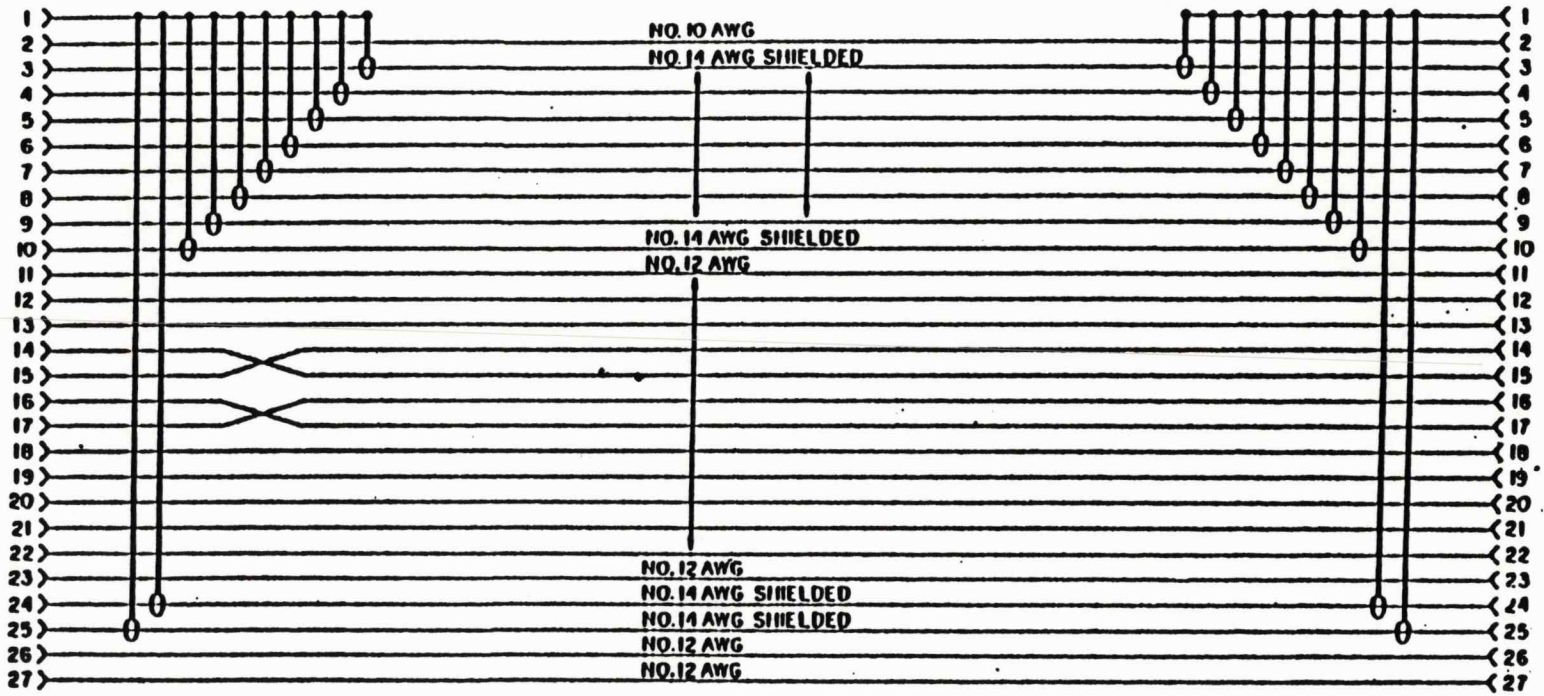
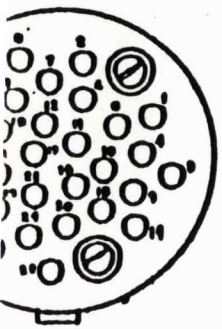


FIGURE 2.31 B - WIRING DIAGRAM - 27 POINT
COMMUNICATION JUMPER CABLE, LOCO - LOCO - CAR



END DETAIL

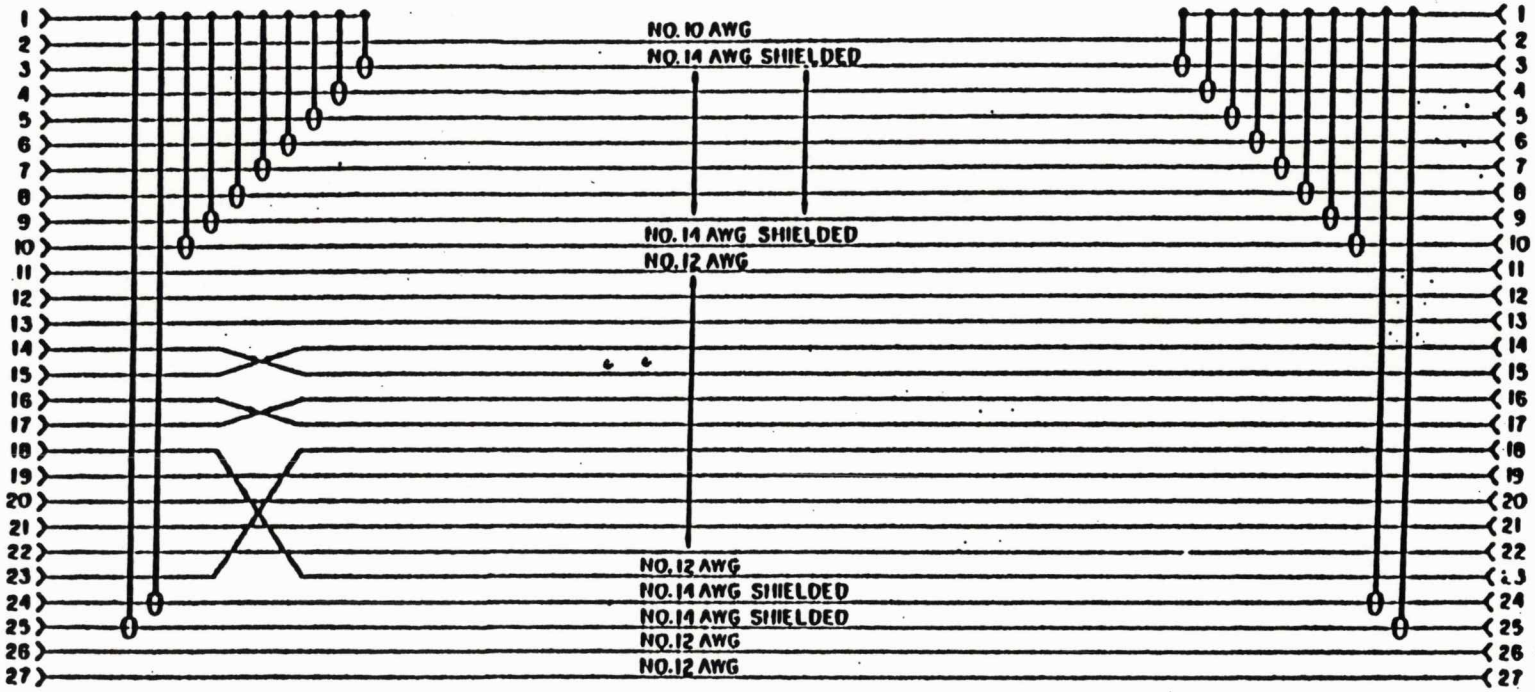


FIGURE 2.31C - WIRING DIAGRAM - 27 POINT COMMUNICATION JUMPER CABLE, CAR - CAR

The 480V jumper cables must be handled with care if they are expected to give good service:

1) Cables should not be left laying on the ground, but rather, be hung up on an appropriate rack.
2) Cables should be kept dry. This is especially true when a cable is being inserted into a receptacle. A wet jumper or receptacle can cause the connection to blow apart when power is applied.
3) Contacts should be kept clean. If dirty, they can be cleaned with the solvents listed in figure 2.33.
4) Cables should be pushed into the receptacle with care, not forced in, nor pounded in. If the cable won't go in, something is wrong-find out why, don't force.
5) Remove the cables by hand. Don't pry them out, and under no conditions uncouple the car and let the train pull the cables loose.
6) If a cable looks defective, don't use it. Label it bad and put it aside for repair or inspection.
7) Test cables periodically per test PO-79-1 test 2.8.

Train Length Limits

Train length is limited by a combination of locomotive (or yard) generating capacity and the coldest or hottest weather the train will experience during its run. Refer to figure 2.32.

When the train is on shop power, either the generating capacity or the 480V yard cables are the limiting factor. Since yard power is normally supplied, the train via 2 cables, the current must not exceed 800 amps, the rating of 2 cables (400 amps each). Refer to figure 2.37.

Refer to figure 2.35 for jumper cable installation instructions, section 6.2 for 480V system details, and test spec. PO-79-1 tests 2.3, 2.7 and 2.8 for trainline and jumper tests.

Trainline Jumper Repairs

Pyle National jumper cables are field repairable. Refer to "Trans-Power Jumpers Assembly Manual PN-12," fig. 2.34 for details.

POWER REQUIREMENTS – HEP CONVERTED SINGLE LEVEL CARS						
HEP POWER UNIT	CAPACITY @0.8 PF	WINTER			SUMMER	REMARKS
		DOWN TO 0° F	0°F TO -10°F	-10°F TO -20°F		
P30 OR POWER CAR (1 HEP UNIT)	375 KW	9 CARS	8 CARS	7 CARS	13 CARS	
F40 PH, AEM7 OR SDP 40 W/ HEP UNIT	500 KW	12 CARS	10 CARS	9 CARS	18 CARS	
E60, P30 OR POWER CAR (2 HEP UNITS)	750 KW	18 CARS	16 CARS	14 CARS	18 CARS	HEP CAPABLE OF 21 CARS IN SUMMER
F 40 (R)	800 KW	18 CARS	17 CARS	15 CARS	18 CARS	HEP CAPABLE OF 25 CARS IN SUMMER
(2) P30'S W/ 3 HEP UNITS	1125 KW	18 CARS	18 CARS	18 CARS	18 CARS	HEP CAPABLE OF 22 CARS IN WINTER & 34 CARS IN SUMMER

NOTES: 1. ALL CONSISTS INCLUDE ONE DINER, ONE LOUNGE, AND THREE BAGGAGE CARS.

2. COACHES (INCLUDING AMFLEET) AND SLEEPERS (INCLUDING SLUMBERCOACHES AND BAGGAGE DORMITORY CARS) CAN BE CONSIDERED TO IMPOSE EQUAL LOADS UNDER SAME CONDITIONS.

3. POWER LOADS

	WINTER	SUMMER
1 BAGGAGE CAR =	1/2 OF COACH CAR	1/10 OF 1 COACH CAR
1 DINER =	2 COACH CAR LOADS	3 COACH CAR LOADS
1 LOUNGE =	1 1/2 COACH CAR LOADS	2 COACH CAR LOADS

4 MAXIMUM CONSISTS LENGTHS ARE BASED ON:

A. CARS BEING PRE-HEATED OR PRE-COOLED

B. SEQUENCE (MANUAL) STARTING DURING HEATING SEASON (INCLUDING RESTART AFTER PROLONGED TIME OFF POWER)

C. 18 CAR LIMIT FOR OPERATING REASONS

CHART: LRB102

[REVISED 10/27/80]

FIGURE 2.32 TRAIN LENGTH LIMITS

Figure 2.33A

CHEMICAL PRODUCTS APPROVED LIST

CLASSIFICATION: Petroleum Distillate Electrical Cleaner (125°F minimum flash point)

GROUP: 2-A
AMTRAK ITEM NUMBER: 47N9003465
AMMS STOCK NUMBER: 4778803005
UNIT OF MEASURE: Gallon
SOLUTION STRENGTH: As received
PROCEDURE: May be used in a dip tank of wiped on.

PRODUCT NAME	MANUFACTURER	EMERGENCY PHONE NO.
FO-425 (Pure-Solv.)	Hexcel Fine Organics	(201) 472-6800
TPC Solvent	Penetone Corp.	(201) 567-3000

NOTE DO NOT ATOMIZE.
Avoid open flame or sparks. Use with adequate ventilation (120 cu.ft./min. minimum air movement) or with respiratory protection. (two hour maximum exposure per employee per day when respiratory protection is required).

HEALTH/HAZARD DATA

Effects of Overexposure (Threshold Limit Value - 300 ppm)
Eyes-can burn.
Skin - can cause dermatitis.
Breathing - can cuase dizziness.
Swallowing - can cause damage to mucous membranes.

Emergency/First Aid Procedures
Eyes - Flush with water.
Skin - Wash with soap and water.
Breathed - Fresh air; oxygen; get medical attention.
Swallowed - Do not induce vomiting; get midical attnetion.

Fire/Explosion Hazards
Do not use welding or cutting torch in vicinity.
Avoid open flame or sparks.

Spill Procedures
Add absorbent to spill area. Ventilate enclosed space.
Dispose of waste by supervised incineration or in chemical disposal area in compliance with regulations.

PROTECTIVE EQUIPMENT	AMTRAK ITEM NO.	AMMS STOCK NO.
Rubber Gloves	46A9000110	4695208905
Rubber Apron	45A9000009	4601501407
Respirator	47M6000564	4708505507

Figure 2.33B

CHEMICAL PRODUCTS APPROVED LIST

CLASSIFICATION: Electrical Parts Spray Cleaner
(Must not attack plastic)

GROUP: 2-B
AMTRAK ITEM NUMBER: 47A9001063
AMMS STOCK NUMBER: 4704508601
UNIT OF MEASURE: Can
SOLUTION STRENGTH: As received
PROCEDURE: Apply directly to component and allow to evaporate.

PRODUCT NAME	MANUFACTURER	EMERGENCY PHONE NO.
Electrical Safety Solvent	Clarkson Laboratories	(609) 966-5200
Inhibisol	Penetone Corp.	(201) 567-3000

NOTE: Use with adequate ventilation (120 cu.ft./min. minimum air movement) or with respiratory protection.

HEALTH/HAZARD DATA

Effects of Overexposure (Threshold Limit Value - 300 ppm)
Eyes-can burn.
Skin - can cause dermatitis.
Breathing - can cuase dizziness.
Swallowing - can cause damage to mucous membranes.

Emergency/First Aid Procedures
Eyes - Flush with water.
Skin - Wash with soap and water.
Breathed - Fresh air; oxygen; get medical attention.
Swallowed - Do not induce vomiting; get medical attention.

Fire/Explosion Hazards
None.

Spill Procedures
Add absorbent to spill area. Ventilate enclosed space. Dispose of waste by supervised incineration or in chemical disposal area in compliance with regulations.

PROTECTIVE EQUIPMENT	AMTRAK ITEM NO.	AMMS STOCK NO.
Rubber Gloves	46A9000110	4695208905
Rubber Apron	45A9000809	4601501407
Respirator	47H6000564	4798505507

Figure 2.35
480V JUMPER CABLE APPLICATION INSTRUCTIONS

CAUTION: Observe all Railroad Safety Rules and precautions in making connections. Report any receptacles that are damaged; tag defective jumpers.

NOTE The HEP system must be shut down AT THE SOURCE by its controls before any 480V CABLES are touched at all.

I. INTERCAR MAKE-UP

480 volt jumpers to be securely inserted into the 480 volt "RED" receptacles opposite each other. (Four jumpers required between all cars).

II. REAR END OF TRAIN MAKE-UP

480 volt jumper to be securely inserted into and interconnect the adjacent 480 volt "RED" receptacles (two jumpers required.

III. CAR TO LOCOMOTIVES OR POWER CAR MAKE-UP

480 volt jumpers supplied with locomotive must be used and securely inserted in corresponding receptacles (color coded "RED"). (Four jumpers required between car and locomotive, and between locomotives.)

IV. FRONT END OF TRAIN MAKE-UP

Jumpers must be looped across both sides of the locomotive or power car (excepton F40, LRC, P-30, and 693-696 power car, which require none).

V. 480 VOLT TRAINLINE CONTROL CIRCUIT

These cars are equipped with an interlock circuit that requires that all jumpers between cars be connected, plus on the last car of a train, each of the two adjacent receptacles must also be interconnected with jumpers, in order that the 480 volt trainline becomes energized. If any one of the 480 volt jumpers is disconnected or slightly unseated, the power to all cars will be shut off. When all jumpers are secure, the green "trainline complete pilot light(s) in the locomotive will light. (E-60, AEM-7, FL-9 have two, one for each side of the train.)

When a jumper is fully seated in the receptacle, the receptacle cover lie will close against the cable; it should touch or be within 1/16". A troublesome receptacle/jumper can

VI. TROUBLE SHOOTING

A. If a train loses power on the road, the most likely cause is a loose 480V jumper. Check the green "trainline complete" pilot light. If it is on, the trouble is in the locomotive or power car.

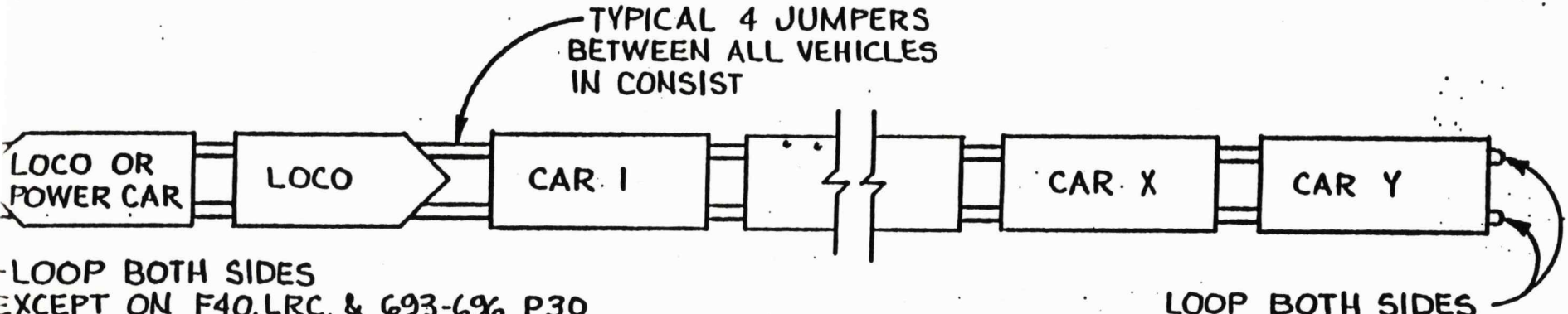
B. If the "trainline complete" light is out, there is a loose jumper. To locate it, inspect each jumper and receptacle for an unseated or loose jumper.

C. If there are no loose jumpers obvious, the fault can be located by looping one side of the train behind the locomotive. If the green light comes on by doing this, the fault is on that side of the train. Since the train should not be run "short looped," (except in an emergency) the fault should be located.

D. Restore the locomotive jumpers to the train and sectionalize the train to find the defect. For example, you could short loop behind a car at the middle of the train - it will tell if the fault is in front of or behind that point.

FIGURE 2.36

480 V TRAINLINE CABLE CONNECTIONS
LOCOMOTE & POWER CAR POWER SOURCE



-LOOP BOTH SIDES
EXCEPT ON F40, LRC, & 693-6%, P30
HICH DO NOT REQUIRE ANY)
EE FIGURE 2.38 FOR LOCO
SET UP SWITCHES

FIGURE 2.37A

480V TRAINLINE CABLE CONNECTIONS - TRAIN ONLY ON YARD POWER

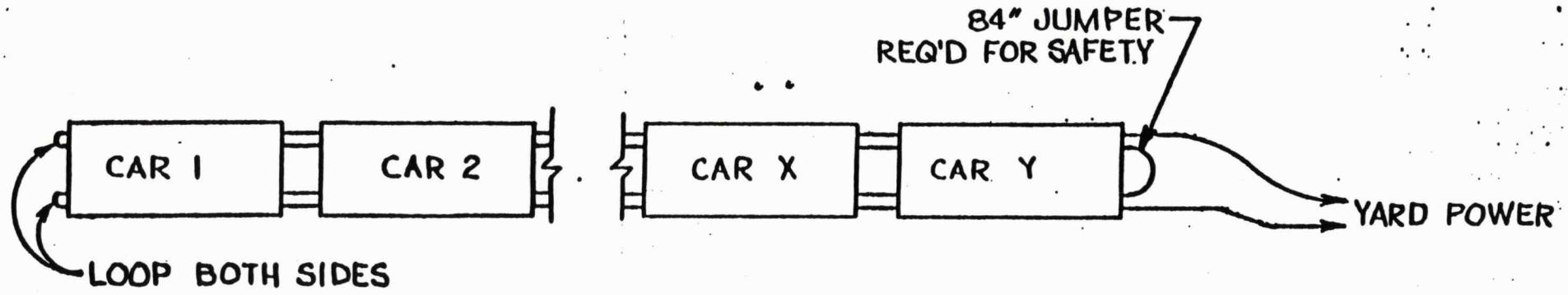
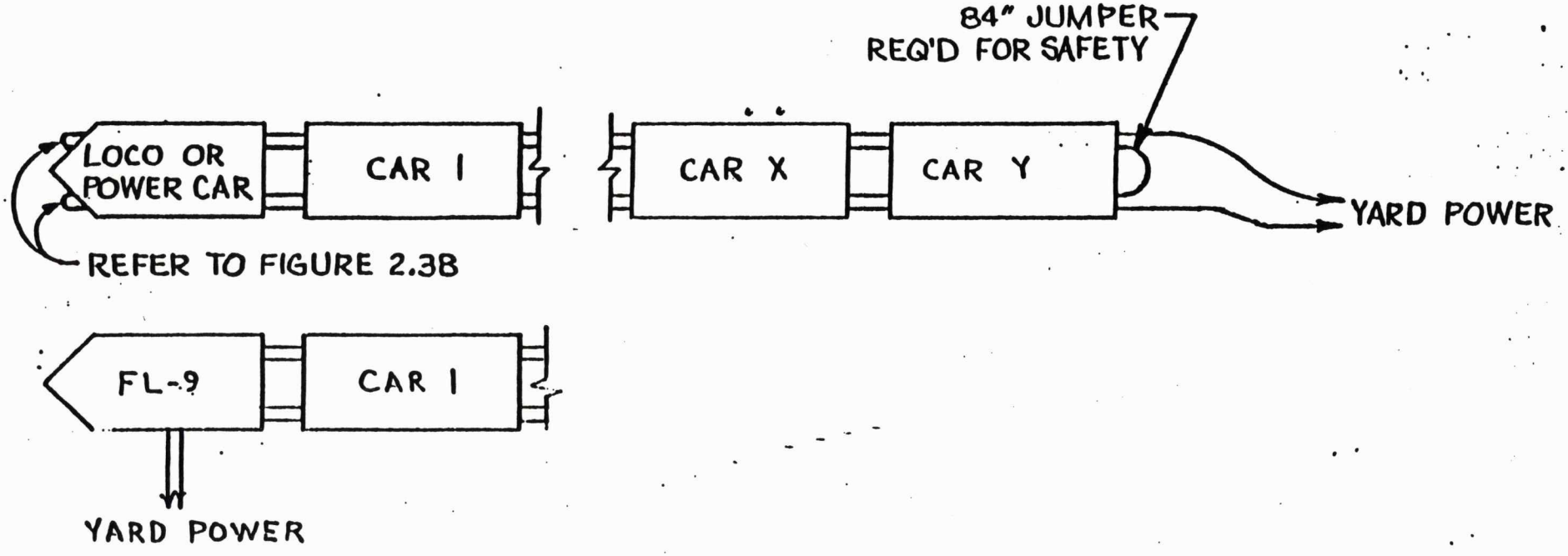


FIGURE 2.37B

480V TRAINLINE CABLE CONNECTIONS: CARS AND LOCO OR POWER CAR ON YARD POWER.



2.6.2 Communication Trainline (Same as Amfleet)

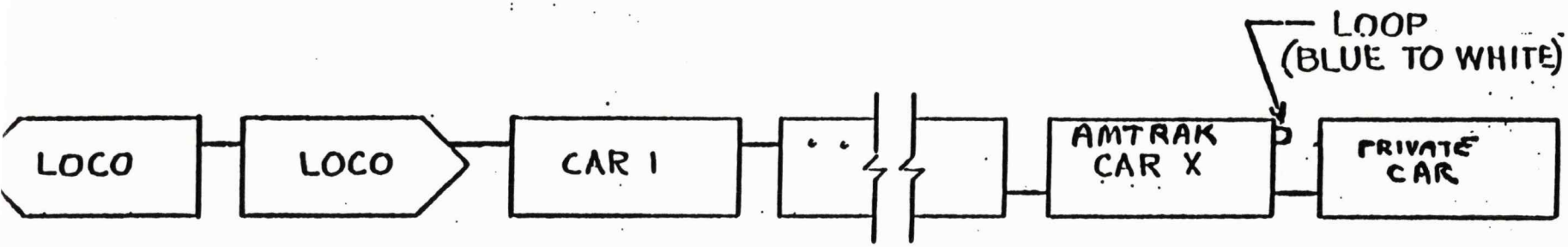
One twenty-seven point jumper and receptacle is provided at each end of the car for trainlining the following circuits from car to car and car to locomotive: All HEP cars use the same 27 point pin arrangement, and thus can be used together. However, the different car groups, (such as Amfleet) have different internal circuit requirements, and on the converted cars, a number of the trainline wires merely pass through the car end to end without connecting to any car equipment; for example, the door control wires.

The 27 point cable system contains the conductor signal, brake applied and released light, PA and intercom trainlines to the locomotive and between all cars, as well as the PA, intercom and music system car to car.

Refer to figure 2.30 for car end connections and 2.31 for jumper cable part list. Refer to figure 2.44 and 2.45 for jumper connections and application instructions. Refer to chapter 6.3 for system details, and test spec. PQ-79-1 tests 2.4 and 2.8.

FIGURE 2-44

27 POINT COMMUNICATIONS CABLE CONNECTIONS



ONE JUMPER BETWEEN EACH CAR, LOCOMOTIVE, AND CAR TO LOCOMOTIVE. JUMPER CAN BE ON EITHER SIDE OF CAR.

Figure 2.45
27 POINT JUMPER CABLE APPLICATION INSTRUCTIONS

CAUTION: Observe all Railroad Safety Rules and precautions in making connections. Report any receptacles that are defective; tag defective jumpers.

NOTE If 480 cables will be touched during 27 point cable application, the HEP system must first be shut down at the locomotive by its controls.

I. INTERCAR MAKE-UP

Communication Jumper (27 point) to be securely inserted into the "Blue" receptacles identified "CAR CNT". One jumper required between cars.

II. REAR END OF TRAIN MAKE-UP

Communication Jumper (27 point) to be securely inserted into the adjacent "BLUE & WHITE" receptacles (one jumper required).

III. CAR TO LOCOMOTIVE MAKE-UP

Communication jumper supplied with the locomotive must be used and securely inserted into corresponding receptacles (color coded "BLUE"). (One jumper required between car and locomotive, and between locomotives.

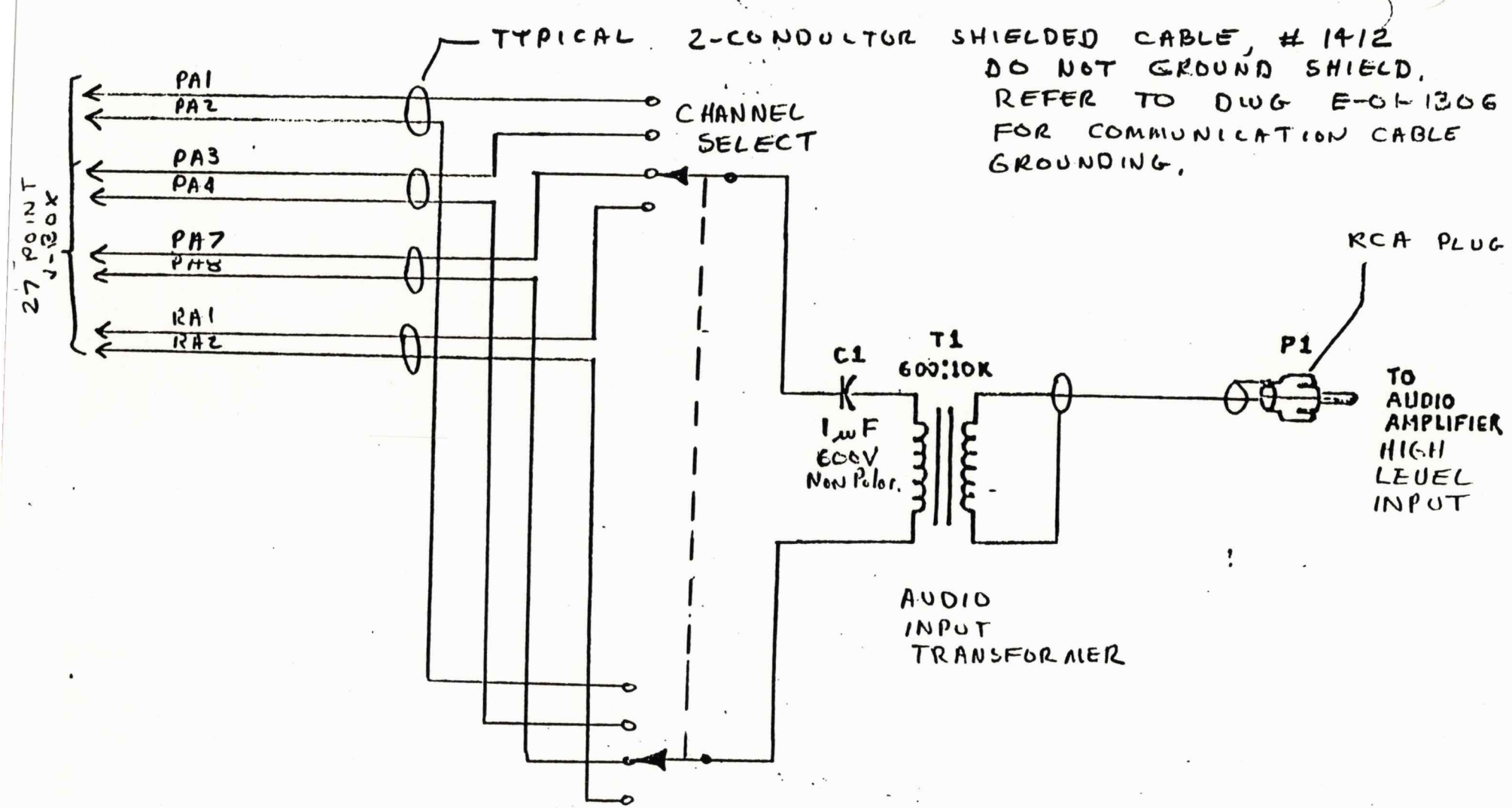
IV. TROUBLE SHOOTING

A defective car, PA Unit or jumper cable can cause the entire train PA system to be inoperative. Defective T/L cable or jumper will usually show up as all the PA units in the train will only work on local, but not on trainline. The 27 point jumpers can be removed one at a time to locate the fault.

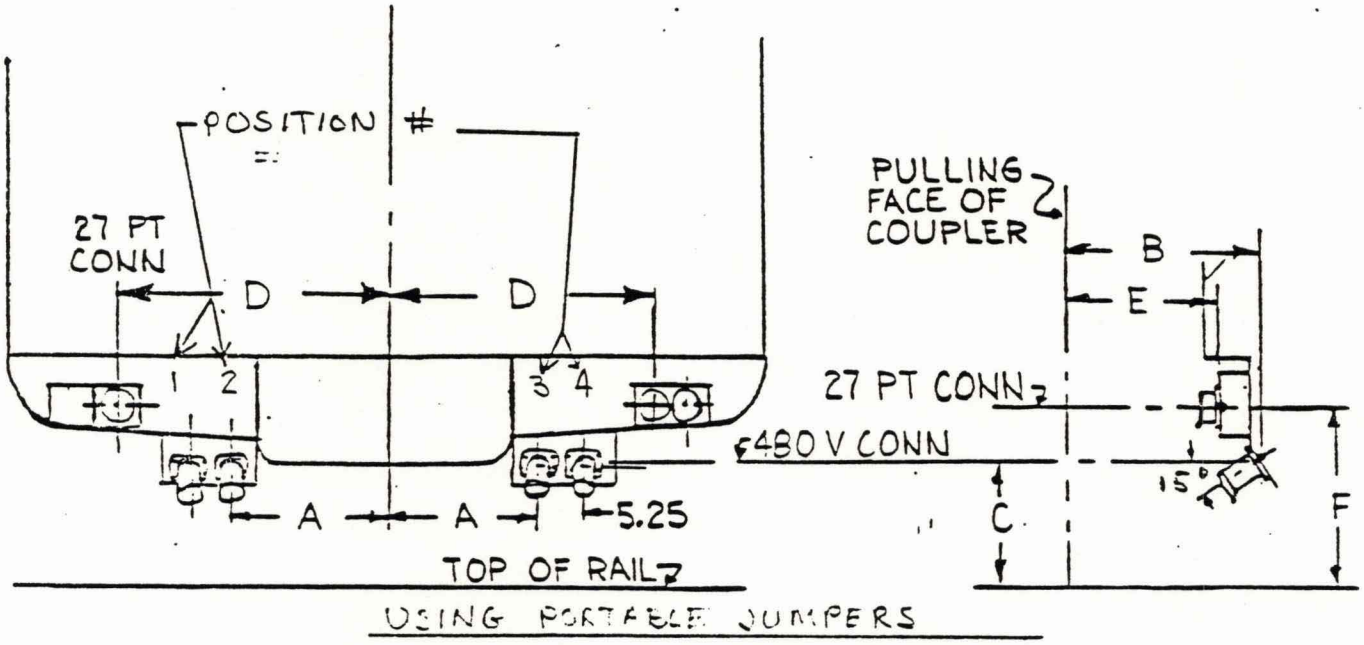
NOTE: All 27 point jumpers must be in place for the conductor signal system to work.

XII Drawings

RFB 10298E	"LISTENING IN"
FIG 3	HEP TRAINLINE CONNECTOR LOCATIONS
C-05-7171	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-05-1355	CLEARANCE DIAGRAM



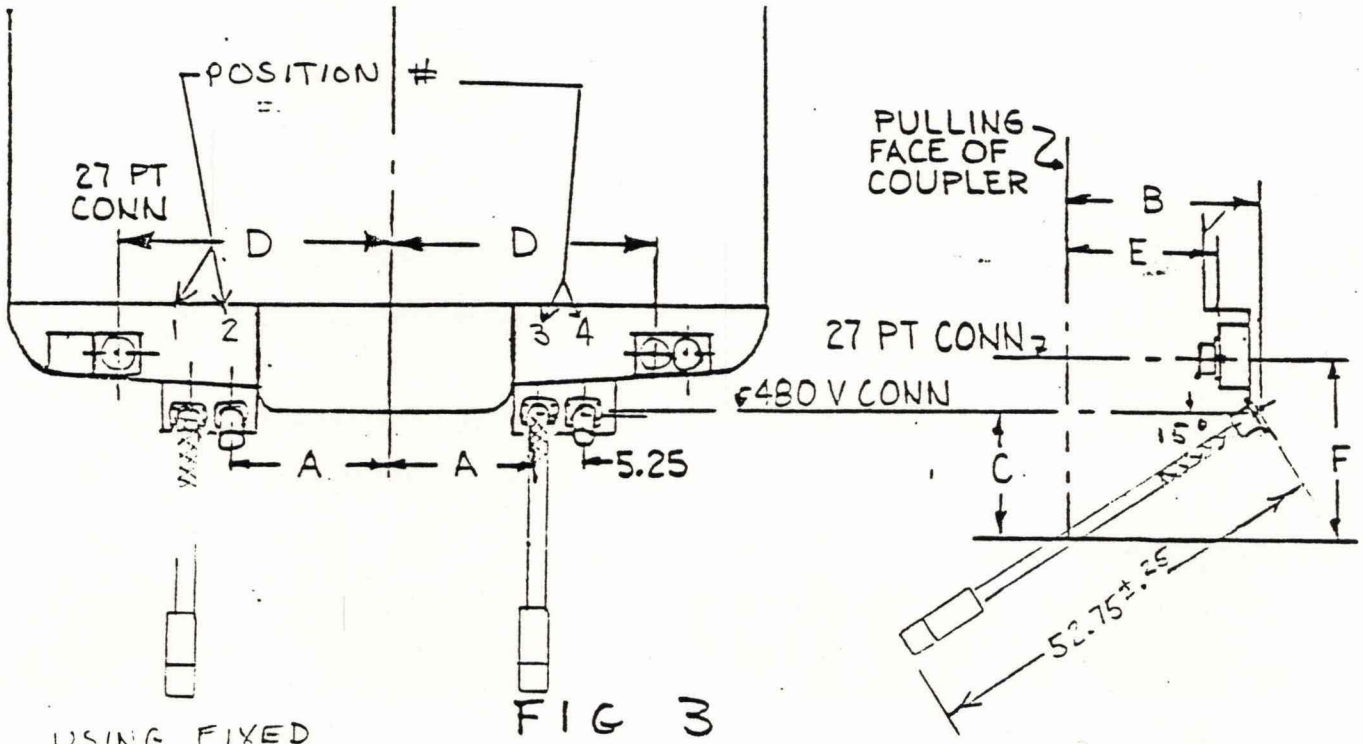
"LISTENING IN" SCHEME
AMTRAK 27 PT
COMMUNICATION
TRAINLINE SYSTEM
REF 10-29-88



USING PORTABLE JUMPERS

51" 480V JUMPER CABLES 60" 27 PT COMMUN. JUMPER CABLE

A	B	C	D	E	F
20.25 $^{+2}_{0}$	20.50 ± 2	27.00 $^{+3}_{0}$	38.25 $^{+2}_{0}$	18.75 ± 1	39.25 ± 1

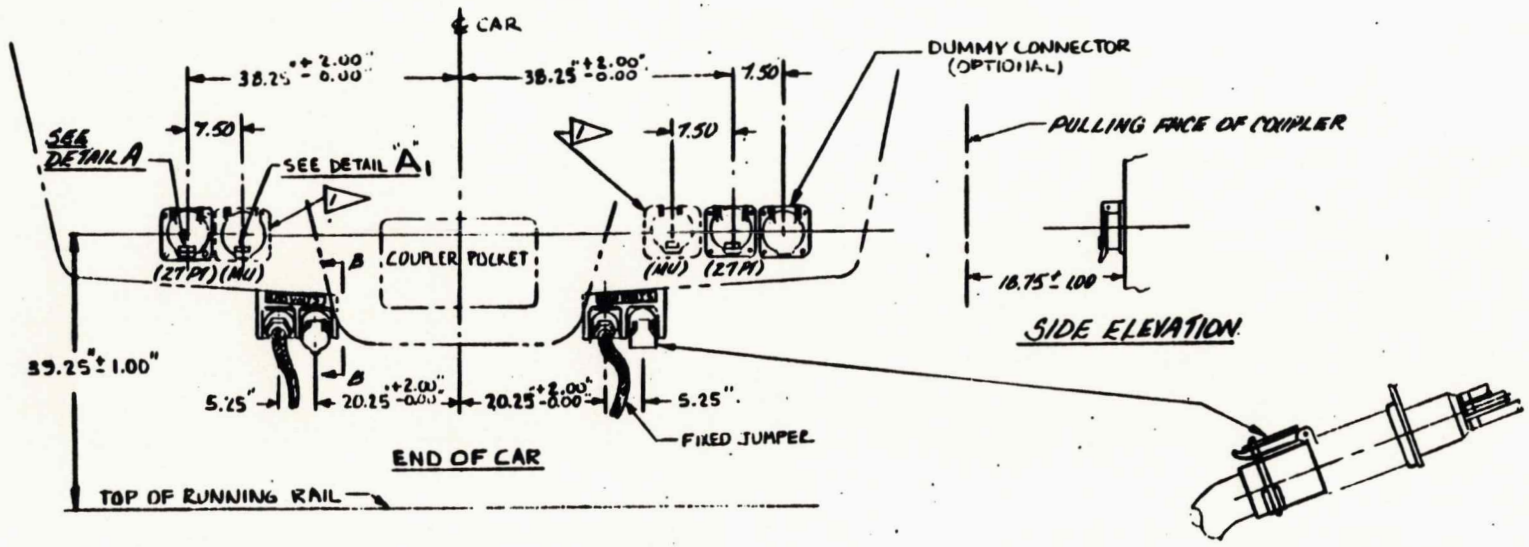


USING FIXED

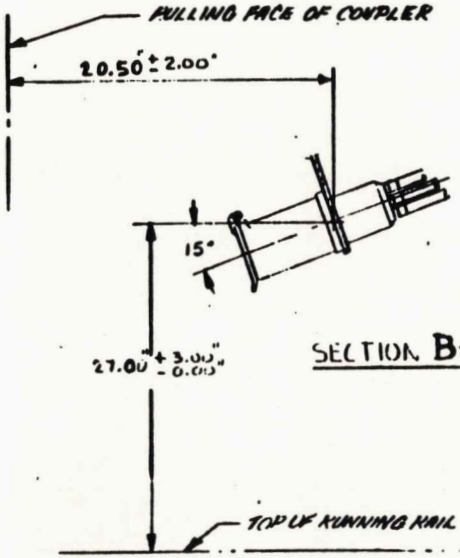
FIG 3

REV. A 10-2-96

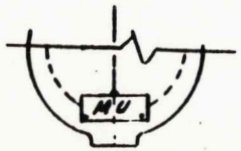
REVISIONS				
LTR	ZONE	DESCRIPTION	DATE	APPR'D
A		ADDED MU T/R LOCATIONS & 480V FIXED JUMPERS	4-4-90	



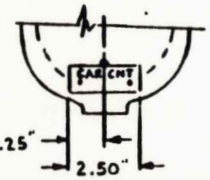
SIDE ELEVATION



SECTION B-B



DETAIL "A1"
MU T/L CONN.



DETAIL "A"
27 PT. COMMUN. CONN.

NOTE:
IF OPTIONAL MU TRAINLINES ARE INSTALLED FOR PUSH-PULL OPERATION, USE LOCATION SHOWN IN DOTTED LINES. SEE DWG.

THIS DRAWING SUPERSEDES SK-D-112779 (W/O CHANGE)

QTY	PART NUMBER	DESCRIPTION	MATERIAL	MFG/SPEC	P/L ITEM NO	ITEM

LIST OF MATERIAL

QTY/CAR	USED ON

REFERENCE DRAWINGS

DO NOT SCALE DRAWING

EQUIPMENT ENGINEERING
Amtrak
National Railroad Passenger Corporation
400 North Capitol Street, N.W. Washington, D.C. 20001

TOLERANCES
Dimensions are in inches unless otherwise specified
Decimals .XX +/- .XXX +/-
Angles ± 5°
Remove all burrs & break sharp edges

TITLE
END OF CAR TRAINLINE CONNECTOR LOCATIONS
(PRIVATE CARS)

Drawn GEN	Approved	Approved	Approved
Checked	Approved	Approved	For Issue

Scale NONE
SHEET 1 OF 1
DRAWING NUMBER C-05-7171
REV A