WABCO

SERVICE MANUAL 6071

TYPE "EL" THREE INDICATION CODED

CONTINUOUS CAB SIGNAL

AND

SS-3 OVERSPEED PROTECTION

OPERATION AND MAINTENANCE

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UNION SWITCH & SIGNAL DIVISION
AMERICAN STANDARD, INC.
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SECTION I

GENERAL DESCRIPTION

The Coded Continuous Cab Signal System was developed to provide in the cab of the locomotive, a signal that is always plainly visible to the engineman, and which at all times shows the conditions ahead and promptly indicates any changes in those conditions.

Means are provided for automatically sounding a warning whistle after a more restrictive cab signal indication is given and for silencing this whistle by operation of an acknowledging switch.

SECTION II

THEORY OF OPERATION

2.1 GENERAL THEORY

The system employs alternating current at a frequency of 90 or 60 hertz per second, fed into the rails at the exit end of the track circuit, as the medium for continuously transmitting indications of trackway conditions to the moving train. This AC track circuit current is the trackway element of the system.

The two proceeding cab signal indications are obtained by interrupting this alternating current at regular intervals, each proceed indication having its own distinctive "code" or rate of interruption. These "codes" may be measured by their number of interruptions per minute, and the values employed are as follows:

Cab Signal Indication	Code
VMA	180 per minute
VL	75 per minute
VR	No Code
SV (Overspeed)	

The VR indication (the most restrictive indication of the system) is obtained not only when the AC track circuit current is cut off, but also in any track circuit in which the alternating current is steady in value and is not interrupted at a code rate.

The system inherently provides immunity from interference of an unsafe character by foreign current because the engine-carried apparatus is designed to respond selectively to the alternating track current periodically interrupted at the code frequencies and to this character of current only.

Voltages of the same frequency and code rate as the rail current are induced in receiver coils carried on the locomotive and these voltages, after being amplified, are used to operate a code following type relay called the "master" relay. This relay in turn governs two decoding units. The 180 decoding unit is responsive to a 180 code rate only, and the 75 decoding unit is responsive to any code rate. The associated decoding relays in turn control the cab signals and the timing valve magnet.

The acknowledging relays are also controlled by the decoding relays in such a manner as to require the engineman to "acknowledge" a change in the cab signal indication when the change is to a more restrictive indication.

SECTION III

CAB SIGNAL INDICATIONS

The primary source of speed information is the wayside equipment, and its purpose is to define the stop points and code change points along the track. The cab signal conveys to the engineman, in advance, the condition of the traffic in the area he is approaching.

Figure 1 shows how the speed limit indication changes as one train closes in upon another train ahead. Assume that Train B enters the first of four blocks with the fourth block being occupied by Train A. As the engine passes the insulated joints, CC, for code change, the VMA aspect will be maintained, and this aspect will persist throughout the first block.

When the engine passes over the insulated joints entering the second block, the cab aspect will immediately change from VMA to limited speed and the warning whistle will sound. The engineman must immediately take steps to bring the train speed down below the limited speed.

When the engine passes into the third block the cab signal aspect will change to VR and the train speed must be reduced below the VR speed. As for the previous code change, the whistle will again sound and the engineman must operate the acknowledging switch to silence the whistle. As mentioned previously, the train must be operated below the VR speed in such a manner as to be able to stop short of any track obstruction.

While Figure 1 shows a train closing in on another train, it should be realized that various wayside conditions will set up any number of variations of the previous analysis. As an example, instead of having Train A in Figure 1, we can have a controlled signal at the cut section between blocks 3 and 4. If this signal is at VR, Train B would operate as previously described since a stop is required at about the same point.

The SV (red) lamp is an overspeed indicator and will be illuminated anytime an overspeed condition exists. For further information on the overspeed see Service Manual 6082 (Overspeed System and Axle Generator).

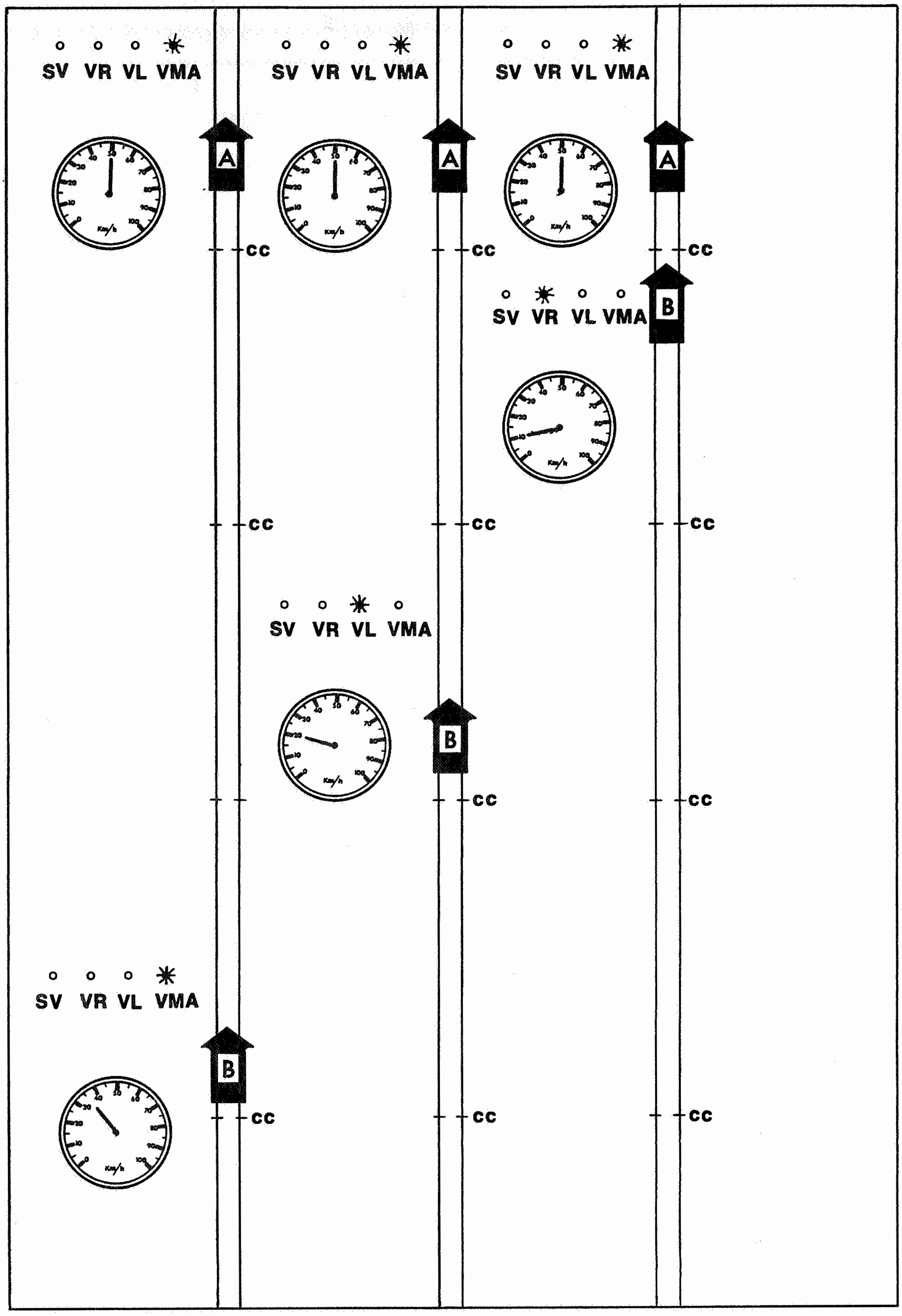

Figure 1. Wayside and Cab Signal Aspect Diagram

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SECTION IV

WAYSIDE CONTROL OF CODED RAIL CURRENT

The apparatus used for operation of the Coded Continuous Cab Signal system consists of two main parts:

1. Wayside Equipment
2. Rolling Stock

The main concern with the wayside will be to point out what must be provided in the track circuits to provide the necessary information in the cab.

The code transmitter, located in the wayside portion of the system, is the mechanism which interrupts the flow of AC. It consists of contacts actuated by an electrically driven pendulum which is mechanically tuned to the code frequency. A separate code transmitter is used for each code frequency.

Located at the code change points are the instrument housings. Inside the housings are relays that continuously detect track conditions on either side of these locations. Then by proper circuiting through the various relay contacts, the following types of energy can be fed into the track rails:

1). With no train approaching, steady 60 or 90 Hz. energy is fed into the rails.

2). With a train approaching a wayside location and the track conditions ahead permit VMA speed, 60 or 90 Hz. energy interrupted at a rate of 180 times a minute will be fed to the rails.

3). With a train approaching a wayside location and the track conditions ahead permit operation at VL speed 60 or 90 Hz. energy interrupted at a rate of 75 times a minute will be fed to the rails.

4). With a train approaching a wayside location and track conditions ahead permit operation at VR speed only, no energy will be fed to the rails. As mentioned earlier, the rail energy as provided under 2, 3, and 4 above will provide cab signal aspects of VMA, VL and VR.

When a train enters an occupied track circuit, NO CODE will be received on the locomotive because the rail current will be shunted by the wheels and axles of the train ahead. Likewise, any condition such as broken wire, open or misaligned switch, or loss of power, or any condition that produces steady (uncoded) AC rail current, or no rail current will result in the display of the most restrictive cab signal indication.

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SECTION V

WAYSIDE CONTROL OF CUT IN/CUT OUT AND RUNNING TEST LOOPS

At certain locations where trains enter and leave cab signal territory, test loops have been installed for the purpose of turning on and turning off the cab signal equipment on the train.

The cut in/cut out loop serves to turn on the cab signal equipment by a 60 or 90 Hz. signal coded at the 180 rate when the train is entering the cab signal territory. When the train is leaving the cab signal territory, the loop is energized with a high energy 60 or 90 Hz. signal coded at the 180 rate. This with proper manipulation of the switches on the lococomotive will cause the cab signal equipment on the locomotive to be inactive.

When it is desired, that the cab signal equipment be cut out at locations other than a cut out loop, such can be accomplished by actuation of the Standing Electric Cut Out (SECO) switch (both decoding relays must be de-energized). The (SECO) switch is located outside of the locomotive or car and can be reached from the ground. This location ensures that the locomotive or car is not moving when the switch is operated.

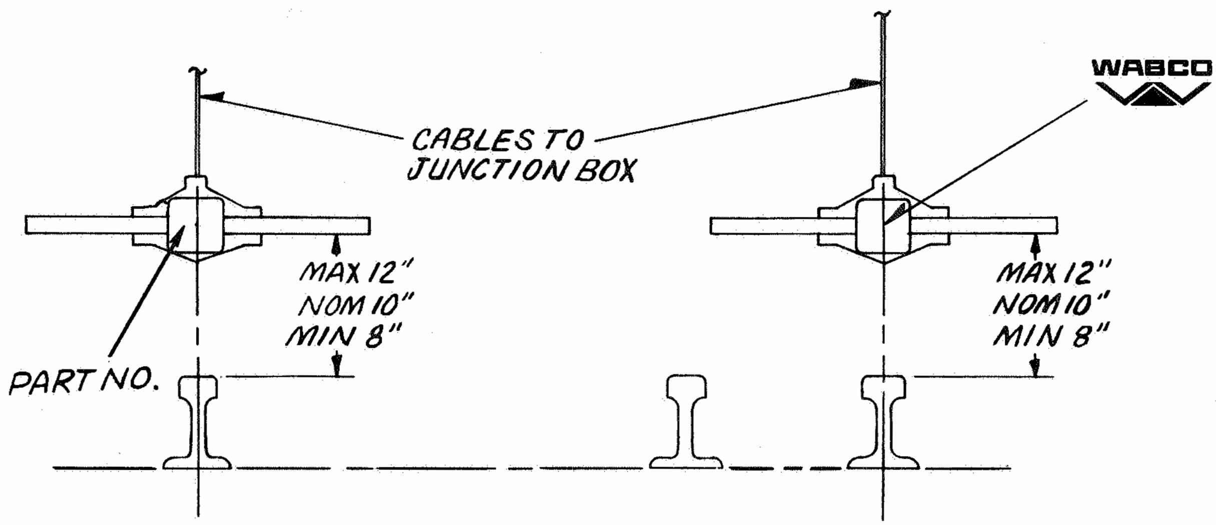
SECTION VI

DESCRIPTION AND LOCATION OF ONBOARD EQUIPMENT

The electrical equipment used in the EL Cab Signal System is shown in schematic circuit form in Figure 6.1 through 6.4.

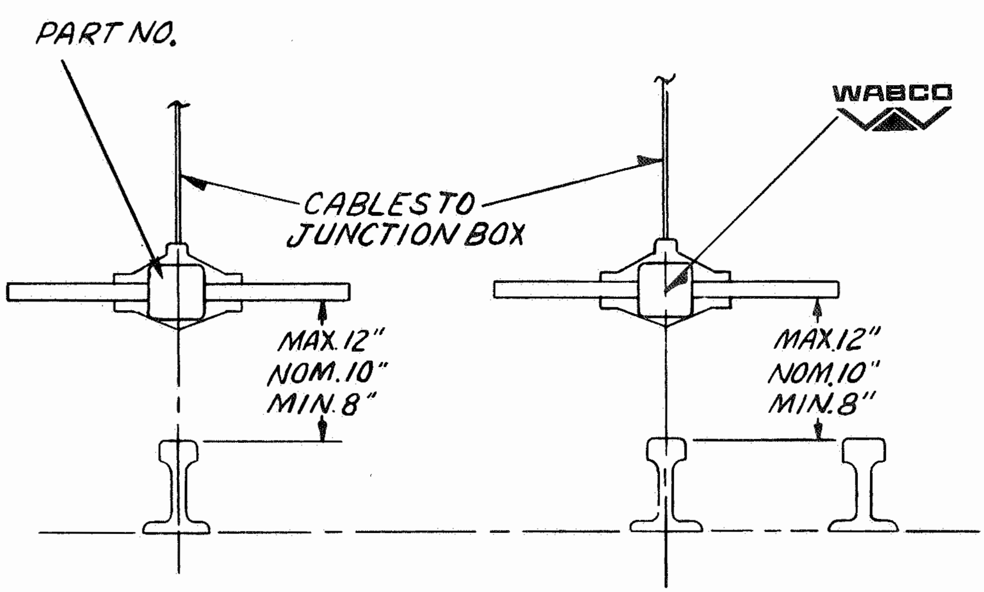
1). The Track Receiver is the unit by which the control is transmitted from the rails to the apparatus on the train. The receiver is made up of a pair of laminated iron bars on each of which is a molded coil complete with cable molded as an integral part. The two coils are connected so that the voltages induced in them by the rail current are additive. The receiver is mounted ahead of the front truck and is so located as to have a clearance of from 8" to 12" between the bottom of the bars and the top of the rail and having the center of the coil mounted directly above the rail.(Figure 2)

2). The equipment box houses the amplifiers, decoding units, control relays and main terminal board. All components of the apparatus are shelf mounted and the shelf is supported at the top and bottom on compression-type rubber mountings designed to afford maximum protection from shock and vibration.



VIEW "C"

NEW CHOPPER CARS - WIDE GAUGE



VIEW "B"

EXISTING DIESELS AND MU - NARROW GAUGE

Figure 2. Typical EL Cab Signal System Receiver Set-Up

The equipment box is of welded steel construction and is dirtproof and watertight when closed.

3). The speedometer is cabin mounted so that its readings are plainly visible to the vehicle crew when in their accustomed positions.

4). The acknowledging switch is located within convenient reach of the engineman. A change in cab signal indication is acknowledged by pressing the button and allowing it to return to normal.

5). For operation outside of a cab signal territory the acknowledging switch, cut out relay and EPCO are used when passing out of signal territory. The speed control and cab signal is cutout by operating the acknowledging switch while passing over a circuit carrying high current at 180 code.

6). DC Power (32V) is supplied from the F42 Converter to the cab signal equipment by way of a 64 Volt battery.

7). The timing valve, OSRP, which is controlled through contacts of the OSR and OSPP relays, forms a link between the electrical and pneumatic equipment. When de-energized, it causes the warning whistle to blow and if appropriate action is not taken within a specified delay timing of 6 seconds, a train control brake application will take place. Air pressure is provided to the 6 second delay horn by way of a reducing valve at a pressure of 3.16 Kg per sq. cm.

8). An electronic governor, which has a magnetic pick-up mounted on the journal box, controls the overspeed relays, which impose the appropriate speed limit as required.

9). A frequency change over switch, located in the cab, is used to select either the 60 or 90 Hz amplifier depending on the territory over which operation is desired.

NOTE:

In some cases the change over switch directly controls the amplifier selection, while in other cases the change over switch controls the FS (Frequency Selection) relay that in turn selects the amplifier to be used.

10). All of the functional elements -- the amplifiers, the master relay, the two decoding units, the one PL-59 relay and the three PN-59 relays -- are separately detachable by means of plug connector terminal boards. Each unit is enclosed in a dustproof case equipped with a convenient handle for removal and carrying of the unit. The amplifier unit and each decoding unit are held in position by a latch and thumb screw.

Each PN-59 relay and PL-59 relay is mounted on a base permanently attached to the rack in the equipment box and is held securely in position by hexagonal nuts applied to the threaded ends of the two guide rods on the mounting base. These guide rods also serve to align the relay so that its plug connectors will properly engage the receptacles on the mounting base when the relay is plugged into position. Each PN-59 relay is identical and, therefore, completely interchangeable. The PL-59 relay is indexed by indexing pins so that it cannot be interchanged with a PN-59 relay.

The GJ relays are front mounted and may easily be replaced by removal of the two mounting bolts and pulling off the push-on wire terminals.

The printed circuit boards are plug connected and retained in their card file by a hold in bar.

SECTION VII

CIRCUIT OPERATION OF ONBOARD EQUIPMENT (Refer to Figure 3)

The input signal for the onboard equipment is picked up from the rails by two receiver coils that are mounted over the rails in front of the lead axle. These two coils are connected in series so that the signals induced into them by the rail current are additive. A two stage circuit, filter and amplifier is located between the track receiver and the master relay. This filter (tuned for 60 Hz or 90 Hz) provides the required rejection of noise that would interfere with the proper operations of the Cab Signal System.

Following the filter is a Darlington connected pair of transistors that amplify the output of the filter. The output of this pair is transformer connected to a fullwave bridge rectifier. The DC from the rectifier bridge is a pulsed signal that is used to turn on and off alternately two Darlington pairs so that the current flowing in the master relay coil reverses in step with the code signal in the rails.

The master relay is of the DC polarized-stick type, that is, its armature will be held by the permanent magnet in whichever position it occupied while last energized. With alternating current of code frequency in its coil, the relay is energized periodically in opposite directions and, therefore, the contacts move from one position to the other at the code frequency. The relay thus responds to code frequency current only when this has a value greater than a predetermined minimum, and its contacts are thereby held firmly closed by ther permanent magnet in one position or the other, except during reversals of current.

When the master relay is operating, it causes direct current from the 32 volt supply to flow alternately through one half or the other half of the primary section of the decoding transformer, causing the magnetic flux of this transformer to alternate in direction of the code frequency and thereby to deliver alternating current of code frequency to the decoding circuits.

The output of the decoding transformer (housed in the 75 code decoding unit) is applied to the 180 decoding unit. The 180 decoding unit is tuned to resonance at 180 code. It consists of a capacitor in series with the primary winding of an adjustable air gap reactive transformer having its low voltage winding connected through a full wave rectifier to the A decoding relay. The A decoding relay will thus respond only when the voltage applied to its associated decoding unit has a frequency of 180 cycles per minute (3 cycles per second) A secondary winding on the decoding transformer is connected through a reactor to a rectifier which feeds to the L relay. This is an untuned decoding circuit and the L relay will respond to any coding action by the master relay.

The contacts of the decoding relays are used to supply 32 volt energy to the proper lamp in the cab indicator, to energize the whistle magnet and to control the acknowledging relays and other various control functions required in the cab signal system.

The acknowledging relays are energized directly whenever the acknowledging switch is pressed. Releasing the acknowledging switch will de-energize the relays unless power is supplied over the stick circuit for each relay. Thus, when in 180 code, no acknowledging relays are held in the energized position. In 75 code, the RP is energized. In no code, the RP and LP relays are energized.

Since the L relay is energized on both code frequencies, on a charge from 180 code to 75 code, the cab signal will change directly from "VMA" to "VL". On 180 code, it does not matter, if the L relay is up since energy is cut off from its contact fingers by the open back contacts of the A relay.

With the A relay picked up, the "VMA" cab signal is lighted over the following circuit; B32, contact 8-7 on the EPCO contact 2R-1R on the SECO switch, terminal post 18, #2 front contact on the A relay, terminal post #23 to the "VMA" lamp in the speedometer. Under this condition, energy is delivered to the timing valve B32, contacts A and B of the OSR, contacts C-D on the OSRP, terminal post 34, 3L and 4L of the SECO switch, a closed contact on the stop insuring pressure switch, to the TV Magnet. Return common is through a second contact on the stop insuring pressure switch.

De-energizing either the OSR or the OSPR relays will de-energize the timing valve. The OSR relay is controlled by the overspeed detection circuits and the OSPR relay is controlled by the contacts of the acknowledging relays. On code change from 180 to 75, the A relay will release and the L relay will remain energized. The "VL" cab signal will then be lighted by energy from terminal post 18, #2 back of the A relay, front contact of "L" relay, VL Lamp to C. The circuit of the VMA cab signal will be broken at the #2 front contact of the A relay. The OSRP relay circuit will be broken by the opening of #1 front of the A relay.

De-energizing the OSPR relay breaks the power to the timing valve and causes the whistle to sound, and if the speed is below the allowable maximum speed for the "VL" aspect and acknowledgement is made, the timing valve magnet will be re-energized.

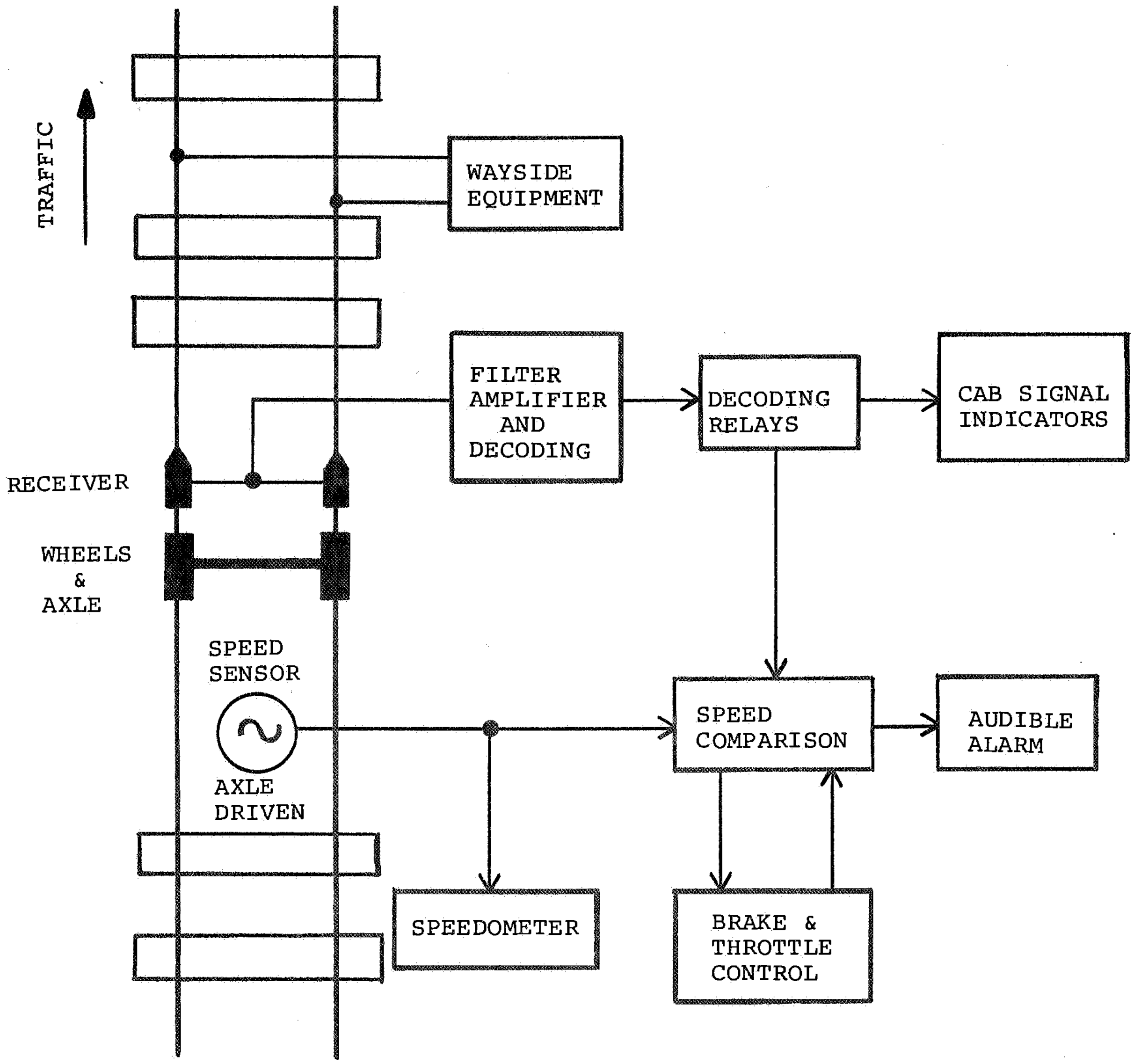


Figure 3. EL Cab Signal Speed Control System Block Diagram

Acknowledgement applies 32 volt power to the RP relay over the following path: B32, acknowledging switch in the acknowledge position, terminal post 27, #1 back contact of relay CO to the pick-up coil of the RP. Stick energy for the RP relay coil is supplied from B32, #1 back contact of A, front contact of RP, stick coil of relay RP to C. When the acknowledging switch is returned to the normal position, energy for the timing valve magnet is supplied over the same path as described earlier for the "VMA" signal. The OSRP being energized from B32, #1 back of the A relay, #1 front contact of the L relay, front contact of RP, back contact of LP, terminal post 32, acknowledging switch to term 29.

NOTE

> The speed for "VL" must be below the speed allowable for that aspect in order that relay OSR will be energized.

On a code change from 75 to no code, the L relay will release and the RP relay remains energized. The release of the L relay breaks the circuit to the timing valve magnet causing the whistle to blow. The "VR" cab signal will be lighted over B32, back contacts of A and L relays. VR Lamp to C. If the speed is below that of a "VR" signal, acknowledgement can be made. This energizes the LP relay over the back contacts of the A and L relays. The timing valve magnet is re-energized and the whistle stops blowing as described earlier.

A change in code to a less restricting signal, for example a higher speed limit does not require acknowledgement. Going to a 75 code from no code will pick the L relay, breaking the stick circuit to the LP relay. The L relay front contact L1, maintains power to the OSPR relay through the front contact of RP and the back contact of LP. Since the higher speed limit is not exceeded, the timing valve remains energized and the whistle does not blow. Similar action occurs on each upward move, each time de-energizing the appropriate acknowledging relay.

Operation in non signal territory is accomplished by acknowledging, while passing over the high energy cutout loop at the end of signal territory. When this is done, the appropriate resistor is connected in series with the track receivers so that a normal signal level is delivered to the input terminals of the amplifier. The high energy level in the cutout loop is coded at the 180 rate, thus the A relay will become energized. Under this condition, energy is delivered to the P coil of the EPCO from B32, Acknowledging switch, terminal post 27, #3 front of A, terminal post 35, P coil of EPCO to common. Approximately 3 seconds after the P coil on the EPCO has been energized, the contact fingers on the EPCO will move. The cab indicators lights will go dark, and the

CO relay will be energized. Energy will be delivered to the timing valve magnet over contact 10-9 of the EPCO and the whistle will stop blowing. When the end of the cutout loop has been reached, the acknowledging switch may be released and the "cut out" will be sealed in.

Automatic cut in will occur anytime either decoding relay is energized for at least 4 seconds. When signal territory is re-entered and the track receivers are over a track circuit carrying coded cab signal energy, the warning whistle will start to blow and the cab signal indicator will light and display the then applicable cab signal indication. If 180 code is received, an acknowledgement is not required and the whistle will not blow. However, if 75 code is received, then an acknowledgment must be made and the speed must be within that imposed by the cab signal.

SECTION VIII

MAINTENANCE AND TESTING OF ONBOARD EQUIPMENT

8.1 FIELD MAINTENANCE

For testing the onboard equipment, the main power switch must be closed and the voltage measured between the B32 and C terminals on the equipment box terminal board, should lie between the limits of 30 and 34 volts. Circuit protection is provided by two 5 ampere fuses of the glass enclosed removable cartidge type in tubular holders, flush mounted on the support bracket along with the power and wheel wear switches. These fuses are located in the 32VDC supply circuit and can readily be extracted from their holders for examination by unscrewing the threaded cap marked "Fuse". (WABCO UJ71163)

CAUTION

All amplifiers and decoding units are drawn tightly into position with a hardened locking screw. Care must be given to see that all units are pulled up tight before closing the equipment doors otherwise equipment may be damaged.

Relays PN-59 and PL-59 are held in their fully inserted place by means of elastic stop nuts which engage the threaded ends of the relay guide rods. These relays, anyone of which, may be removed by first removing the two elastic stop nuts and pulling directly on the handle of the relay. To insert a relay on the rack, it should be started by first bringing it up slowly to the point where the relay plug connectors begin to engage the spring receptacles in the mounting bases. When it is determined that the plug connectors and receptacles are in proper alignment, the relay should then be pushed to its final position. The primary purpose of the guide rods is to support the relay and provide a means of tightly clamping it against its mounting base.

CAUTION

Do not push relays into plug connectors from end of guide rods, receptacle or relay damage may occur if proper alignment is not obtained.

Pickup adjustment is made by use of a variable resistor with a slotted top and located on top of the amplifiers and marked pickup adjustment. This resistor is equipped with a locking nut for lock down after adjustment is made.

To check and adjust pickup, proceed as indicated in the instruction manual for the test. However, the track receivers must be positioned directly over the test loop or rails and 8 to 12 inches (203 to 304 mm) above the rail or test loop.

Move code selector switch on test set to the 180 code position and slowly increase rail current until master relay begins to operate uniformly. The rail current frequency must agree with that of the amplifier being checked.

Depress "steady current" pushbutton switch on test set and read rail current. This value of current should not be less than 1.95 amps nor more than 2.4 amps. If the pickup is outside these limits, it may be raised by turning the pick-up shaft adjustment clockwise and lowered by turning in a counterclockwise rotation.

NOTE

Master Relay operates on other codes with 2.4 amps in the rail circuit.

If the pickup test of the cab signal equipment cannot be brought within limits of 1.95 amps and 2.4 amps by means of the pickup adjustment, it may be that the amplifier is defective. This should be determined by replacing it with an amplifier known to be in good operating condition and if this results in the pickup being brought within proper limits, the defective amplifier should be sent to the repair shop for further test.

Although the 180 and 75 decoding units appear to be identical, the components inside the case are different. To prevent a decoding unit from being inserted in the wrong place in the equipment box, the indexing pin and connectors are arranged differently on two units. A test jack is provided in each decoding unit to measure the current to the unit. The currents tested should conform to the values given in Table B.

When the decoding current values no longer conform to the values given in Table B, the decoding unit involved should be removed and sent to the relay shop for test and inspection.

SECTION IX

MAINTENANCE AND TESTING OF ONBOARD OVERSPEED EQUIPMENT

The axle generator, two printed circuit boards, and the speedometer are all contained in the overspeed subsystem. The axle generator is directly coupled to the axle of the car or locomotive. The electrical output from the axle generator is an AC signal with a frequency that is proportional to speed.

One printed circuit board - the Shaper Limiter, performs its functions as follows:

1). Provides an AC signal to the speed governor that is proportional to speed.

2). Provides an output signal when the vehicle is not moving.

3) Produces the speedometer drive signal.

The second printed circuit board, Speed Governor, receives the speed signal and also a DC signal from the Shaper Limiter printed circuit board. The DC signal from the Shaper Limiter is passed through the decoding relay matrix which establishes the allowable speed limit. The circuitry on the speed governor board compares the speed established by the signal in the rails and the actual speed as indicated by the signal derived from the axle generator. At any time the actual speed exceeds that allowed by the signal in the rails, the overspeed relay will be de-energized.

The speed governor board characteristics are modified slightly by the wheel wear switch so that compensation may be made in the speed signal as the diameter of the wheel is reduced by its wear or grinding.

Frequency of the speed signal from the axle generator required for the various speeds are shown in the following table.

CLASS OF VEHICLE	SIGNAL ASPECT	WHEEL DIAMETER (MM)	SPEED KM/H	FREQUENCY (HZ) MAX.	MIN.
MU & CHOPPER MU'S	VL (75 CODE)	914	50	205	193
		895	50	210	198
		876	50	214	202
	VR (NO CODE)	914	20	89	77
		895	20	91	79
		876	20	93	81
3700 DIESEL LOCOMOTIVES	VL (75 CODE)	1050	35	128	118
		1029	35	130	120
		1003	35	134	123
	VR (NO CODE)	1050	20	77	67
		1029	20	79	69
		1003	20	81	71
2000 DIESEL LOCOMOTIVES	VL (75 (CODE)	1118	35	120	111
		1048	35	128	118
		980	35	137	126
	VR (NO CODE)	1118	20	73	63
		1048	20	78	68
		980	20	83	72

FREQUENCIES FOR THE ABOVE TABLE MAY BE CALCULATED FROM THE FORMULA

$$\text{FREQ(HZ)} = \frac{3.537 \text{ X SPEED IN Km/h}}{\text{WHEEL DIAMETER IN METERS}}$$

The checking of the overspeed system may be done with the locomotive stationary. An artifical speed signal may be fed into the system by connecting an audio oscillator to terminal posts 40 and 41 with a 0.5 Hy choke 20 ohms or less DC resistance between the oscillator and the equipment box shelf terminals. If the choke is not used, then the OSR will not be energized when the frequency of the oscillator is at a frequency of 12 Hz or less. Note that the magnetic pickup must be connected for proper operation of the system since the inductance of the pickup is used in the circuitry of the Shaper Limiter board. Voltage level out of the audio oscillator should be 0.5 volts RMS for proper operation.

CODE FREQUENCY	LIMITS	SERVICE LIMITS RELAY MILLIAMPERES	
		A	L
180	MAX.		
	NOM.	55	55
	MIN.	48	48
75	MAX.	5	
	NOM.	2	55
	MIN.	0	48
0	MAX.	0	0

TABLE B
DECODING RELAY CURRENT

NOTE

These limits apply with exactly 32.0 volts applied to the equipment and they will vary almost directly with the voltage applied, therefore at 30 volts, the minimum current at the tuned frequency may be 45 milliamperes. Decoding relays - Style PN-59, 40 ohm slow acting-calibration on steady DC.

Maximum Pickup	37.5 milliamperes
Minimum Release	15.0 milliamperes

On code, the pickup will be slightly less and the release slightly higher than the steady DC. readings.

TABLE A

RELAY OPERATION

THREE INDICATION SPEED CONTROL-FEPASA LOCOMOTIVES AND MU CARS										
CODE		Acknowledge Switch Position	Final Relay Position							CAB SIGNAL
			Decoding		Acknowledge					
Seq.	Freq.		A	L	RP	LP	OSR	OSPR	Alarm	Name
UPWARD	0	Normal	D	D	E	E	E	E	No	VR
UPWARD	75	Normal	D	E	E	D	E	E	No	VL
UPWARD	180	Normal	E	E	D	D	E	E	No	VMA
DOWNWARD MOVE	75	Normal	D	E	D	D	E	D	Yes	VL
		Ack	D	E	E	E	E	D	Yes	
		Normal	D	E	E	D	E	E	No	
DOWNWARD MOVE	0	Normal	D	D	E	D	E	D	Yes	VR
		Ack	D	D	E	E	E	D	Yes	
		Normal	D	D	E	E	E	E	No	

ACK = Acknowledge
D = De-energized
E = Energized

NOTE**
The above table is based on no locomotive (car) movement and no artifical speed signal being introduced into the system.

Figure 4. Three Indication Speed Control--
FEPASA Locomotives and MU CARS Relay Operation

SECTION X

PARTS LIST AND ORDERING INFORMATION

If it becomes necessary to replace components during unit maintenance, the following procedures should be followed in obtaining replacement parts.

a) Standard Parts

All electrical and mechanical part replacements for this unit can be obtained through your local Field Office or Representative. However, many of the standard electronic components can be obtained locally in less time than required to order them from WABCO. Before purchasing or ordering replacement parts, check the parts list for the value, tolerence, rating and description.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance in the unit, particularly at high frequencies. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect system performance.

b) Special Parts

In addition to the standard electronic components some special components are used in this unit. These components are manufactured or selected by WABCO to meet specific performance requirements or are manufactured for WABCO in accordance with our specifications. Most of the mechanical parts used in this unit have been manufactured by WABCO. Order all special parts directly from your Local WABCO Field Office or Representative.

c) When ordering replacement parts from WABCO include the following information:

1. Unit nomenclature
2. Unit serial number
3. A description of the part.
4. WABCO part number.

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SECTION XI

EQUIPMENT REFERENCES OF EL CAB SIGNAL SYSTEM

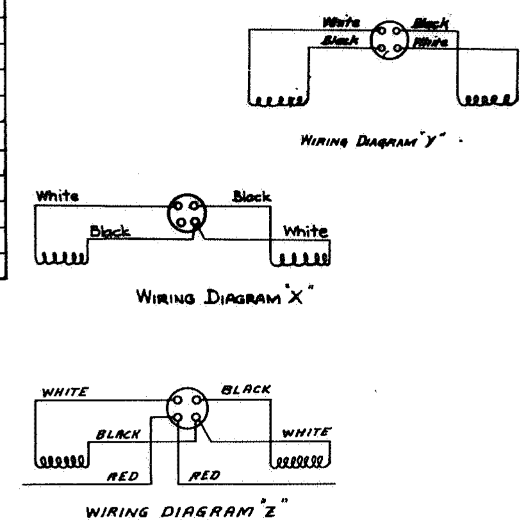
Circuit Plans are included at back of Pamphlet.

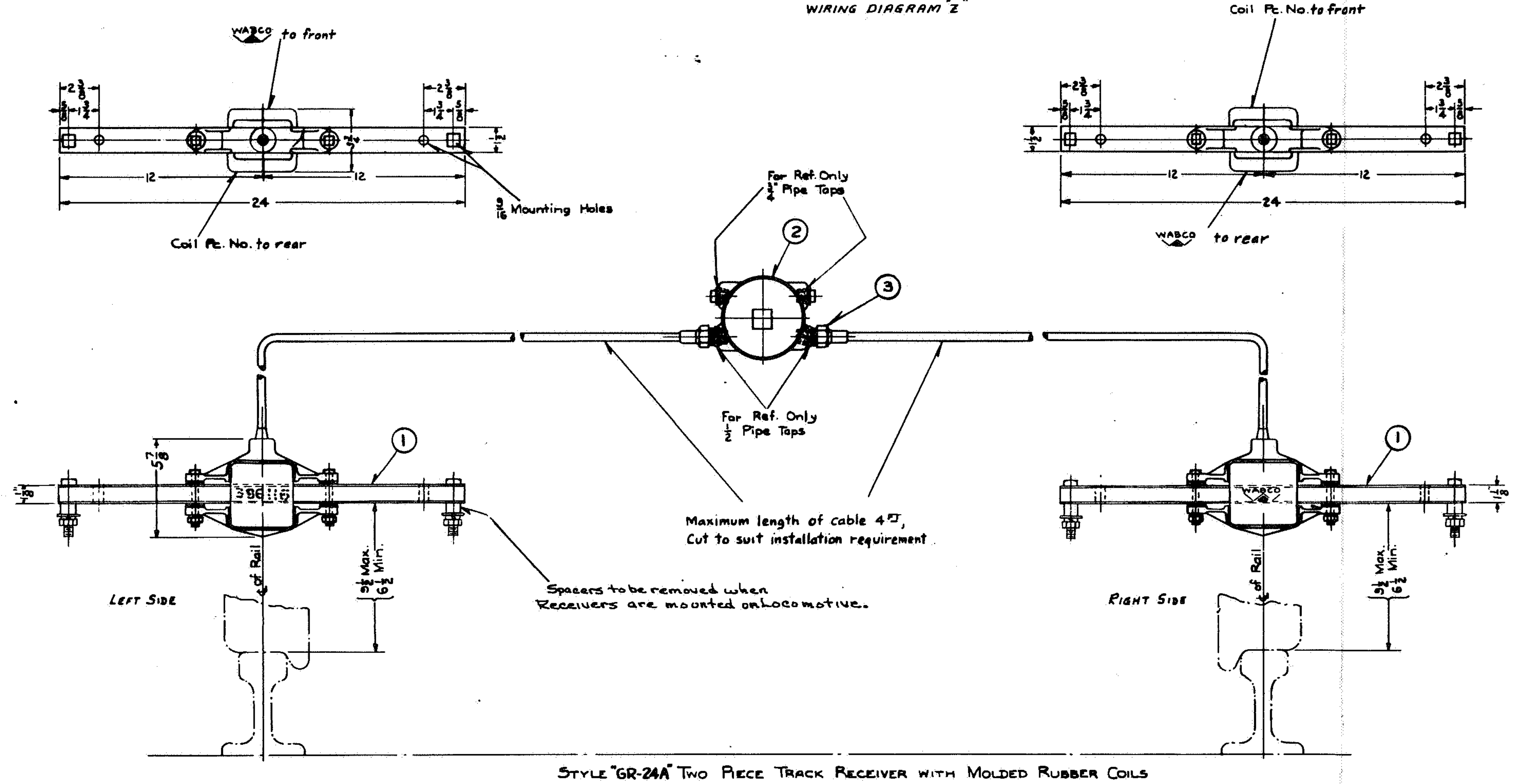
Equipment	Pamphlet #	Part Number
Equipment Box - MU Cars		
and Chopper Cars		UN451088-2701
Locomotives 3700 Series		UN451088-2702
Locomotives 2000 Series		UN451088-2703
Shelf for Box - MU Cars		
and Chopper Cars		UN451489-2901
Locomotives 3700 Series		UN451489-2902
Locomotives 2000 Series		UN451489-2903
Fuse - 5 amp		J71165
Amplifier (60 Hz,)	SM6072	N451463-0201
(90 Hz.)	SM6072	N451463-0202
Master Relay	U-5683-A	N326921
180 Decoding Unit	U-5684-A	N326919
75 Decoding Unit	U-5684-B	N326920
Style PN-59 Relay	U-5624-A	N273665
Receiver (One Unit)	U-5626-A	N396279
Receiver Junction Box		
KP Relay	SM-3623	N191500
Style PL-59 Relay	SU-4549	N386991
Receiver Mounting Bracket		M199455
Receiver Cable Grip		N311300
Acknowledging Switch		
Actuator		J725853
Acknowledging Switch		
Contactor Block		J725707-0069
Timing Valve		J337050
Speedometer		N451126-1701
F-42 Converter	U-5778	N451033-2901
V=0 Shaper Limiter PCB		N451404-6801
Speed Governor PCB	SM6082	
(Locomotives 3700 Series)		N451404-7601
Speed Governor PCB (MU Cars)		N451404-7602
Speed Governor PCB Locomotives		N451404-7604
2000 Series		
EPCO Relay		N143170
Standing Electric Cut-Out		
Switch (SECO)		N300011
Change Over Switch (60/90Hz)		J725707-0068
Magnetic Pickup, Adapter,		
Cable and Connector Ass.		N451125-5502
Magnetic Pickup (only)		J738109
Impulse Generator		J712086
OSR and OSPR Relays		N398348
Cut Out Switch		

S.B.M.	RECEIVER D66209	SH.	JUNCTION BOX C8282	SH.	WIRING DIAGRAM	R.R.	RECIEVER APPLICATION
X396284	UN396279	5	UN215777	3	X	C.R.I. & P., B. & M., E-L	AS SHOWN
						RFFSA-EFSJ (BRAZIL)	PER VIEW "A" D66208-SH.2A
						FEPASA (BRAZIL) EXISTING DIESELS & M.U.'S	PER VIEW "B" D66208-SH.2A
						FEPASA (BRAZIL) NEW CHOPPER CARS	PER VIEW "C" D66208-SH.2A
U0396285	UN396281	5	UN215777	3	Y	L. & N.	AS SHOWN
~~U0432076~~ X432076-001	UN432077	5	UN215777	3	X	I.C.	AS SHOWN
U0432161	UN432160	5	UN215777	3	Z		AS SHOWN
U0435330	UN435329	5	UN215777	3	Z		AS SHOWN

ITEM	REQ'D	PC. NO.	DWG.	SH.	DESCRIPTION
1	2	See Main Tab.			Receiver
2	1	See Main Tab.			Box, Junction
3	2	UN311300	12561	22	Connector, Cable Grip

NOTES
WHEN MOUNTING RECIEVER ON LOCOMOTIVE A MINIMUM CLEARANCE OF 3½ SHALL BE MAINTAINED BETWEEN THE CORE AND ANY FERROUS METAL PART OF THE LOCOMOTIVE.





D66208 SH.2

ALL DIMENSIONS IN INCHES UNLESS NOTED	SCALE 3" = 1'-0"
REQ. 129522	
GEN. DWG. OF TRACK & LOOP RECEIVERS FOR AUTOMATIC TRAIN CONTROL	SHEET NUMBER 2
UNION SWITCH & SIGNAL DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY SWISSVALE, PENNSYLVANIA, U.S.A.	D66208

Figure 5.1A EL Cab Signal System Receiver Diagram

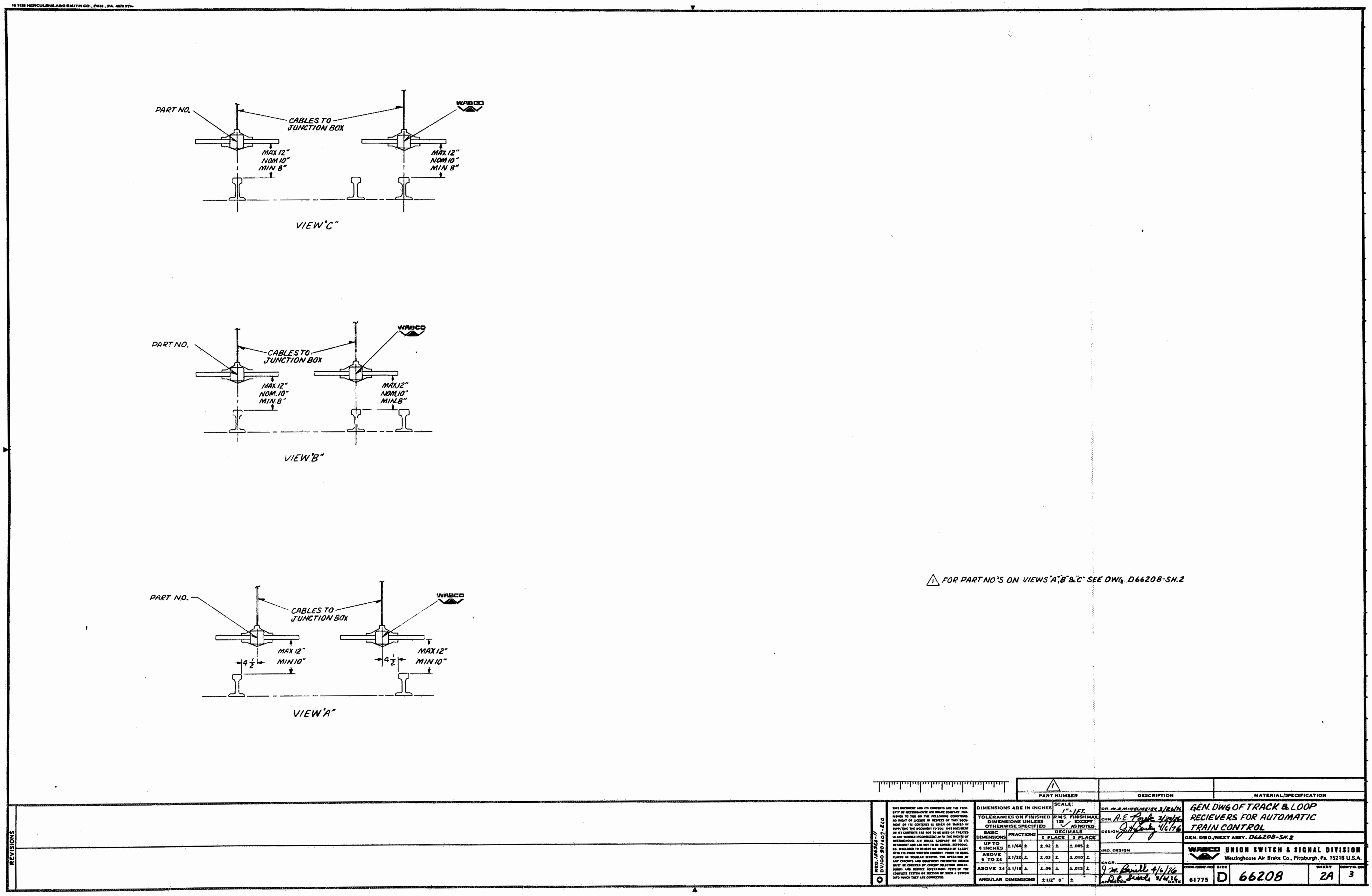


Figure 5.1B EL Cab Signal System Receiver Diagram

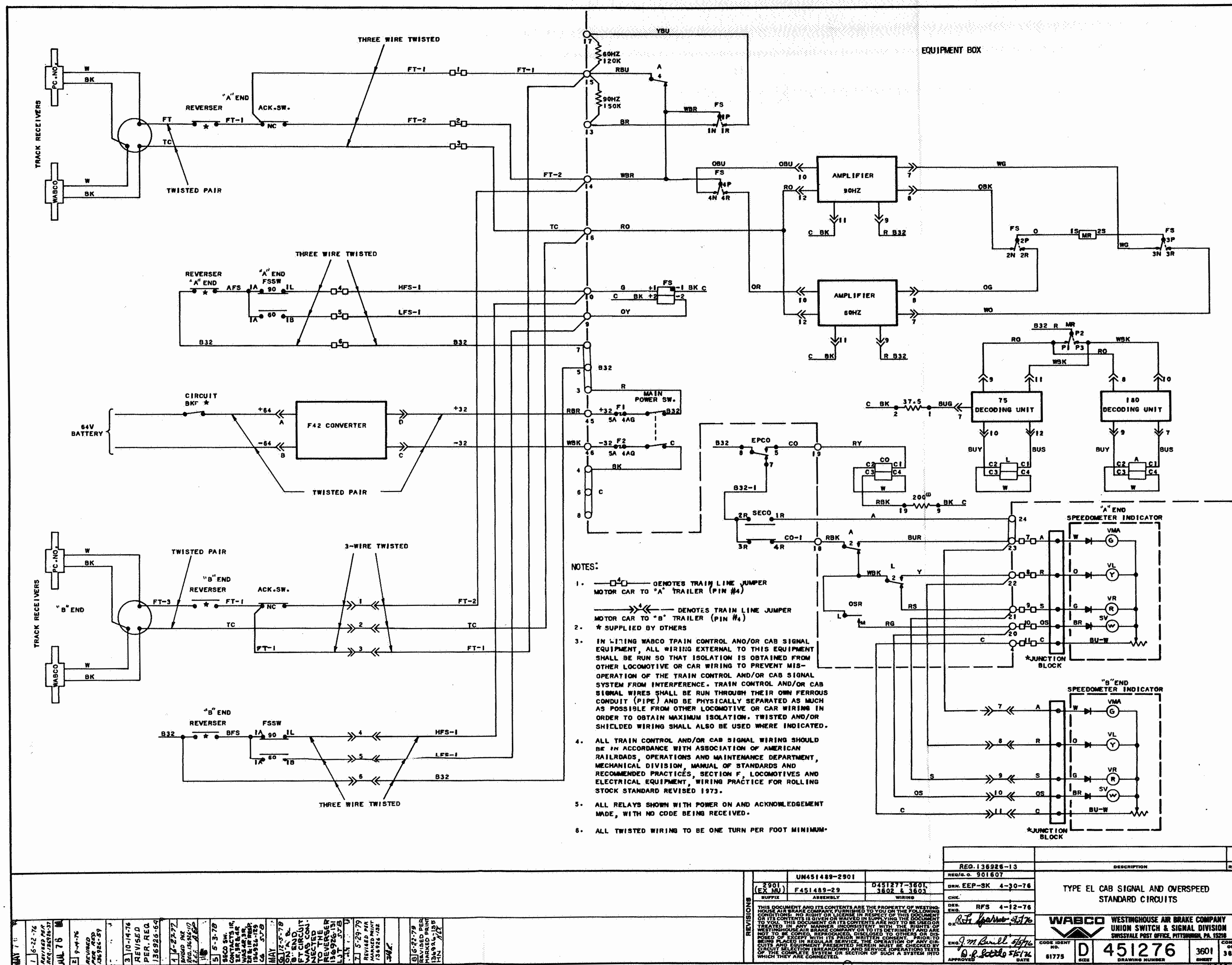


Figure 6.1A Type EL Cab Signal and Overspeed Standard Circuits (EX MU CARS)

WABCO

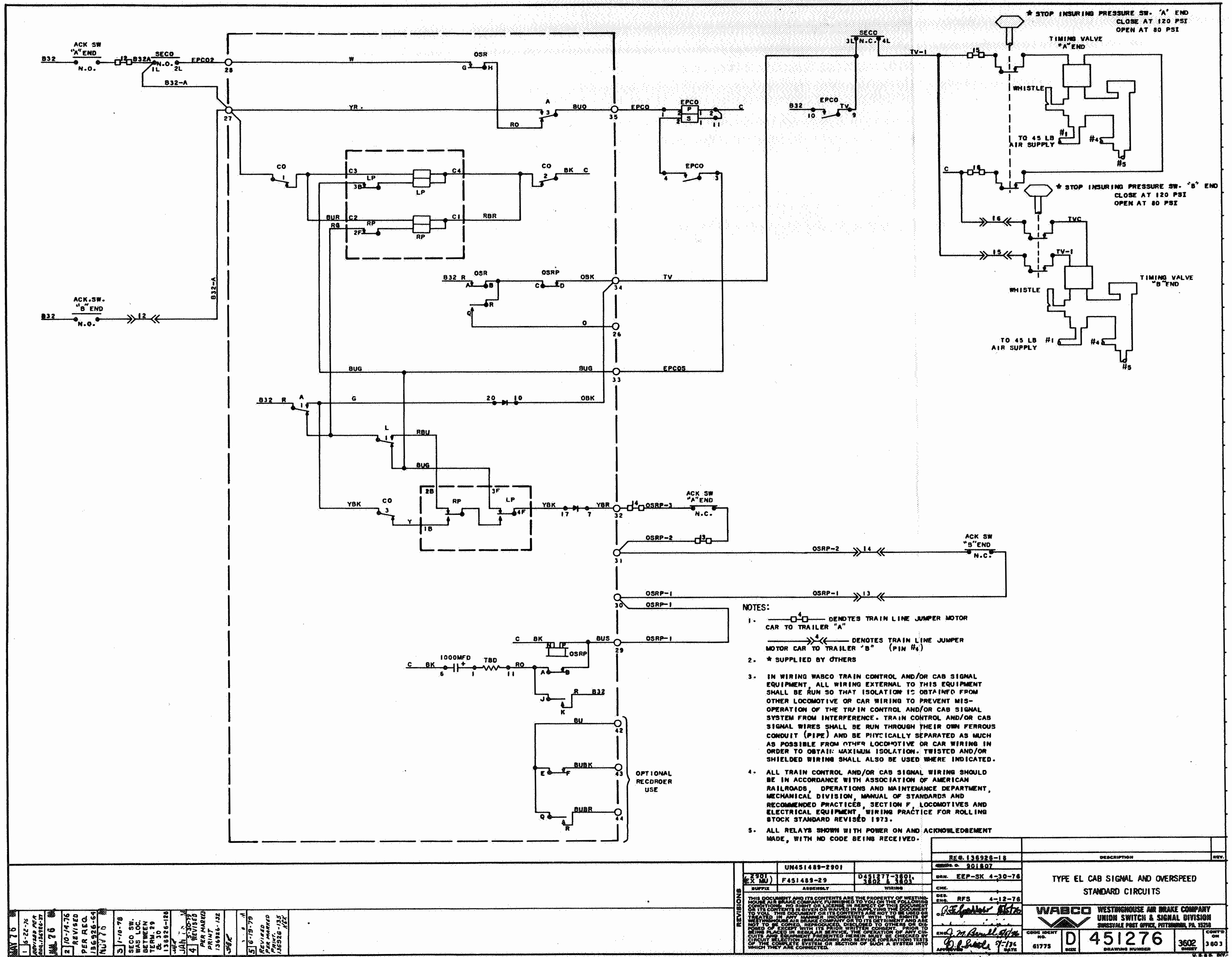


Figure 6.1B Type EL Cab Signal and Overspeed Standard Circuits (EX MU CARS)

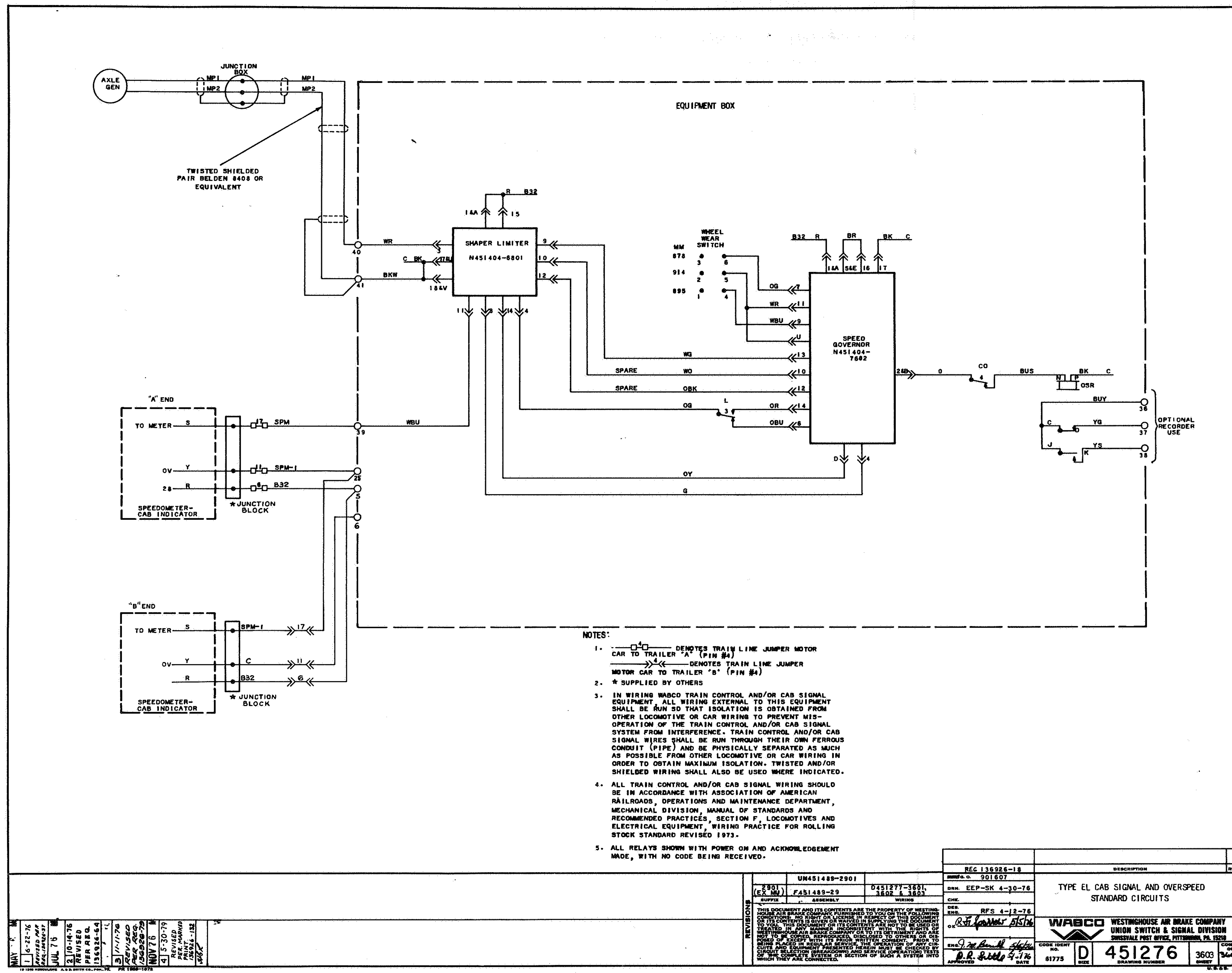


Figure 6.1C   Type EL Cab Signal and Overspeed Standard Circuits (EX MU CARS)

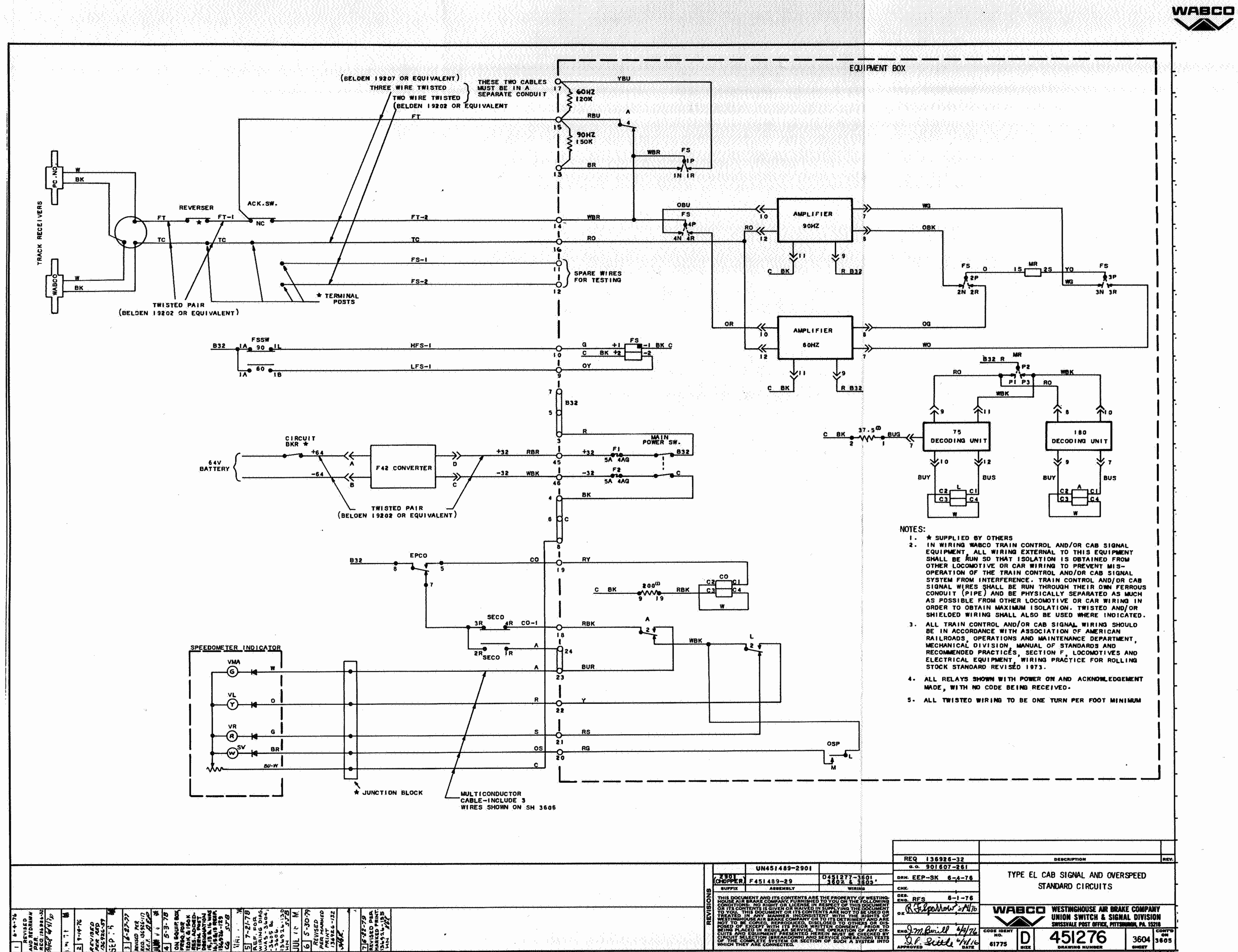


Figure 6.2A Type EL Cab Signal and Overspeed Standard Circuits (Chopper Cars)

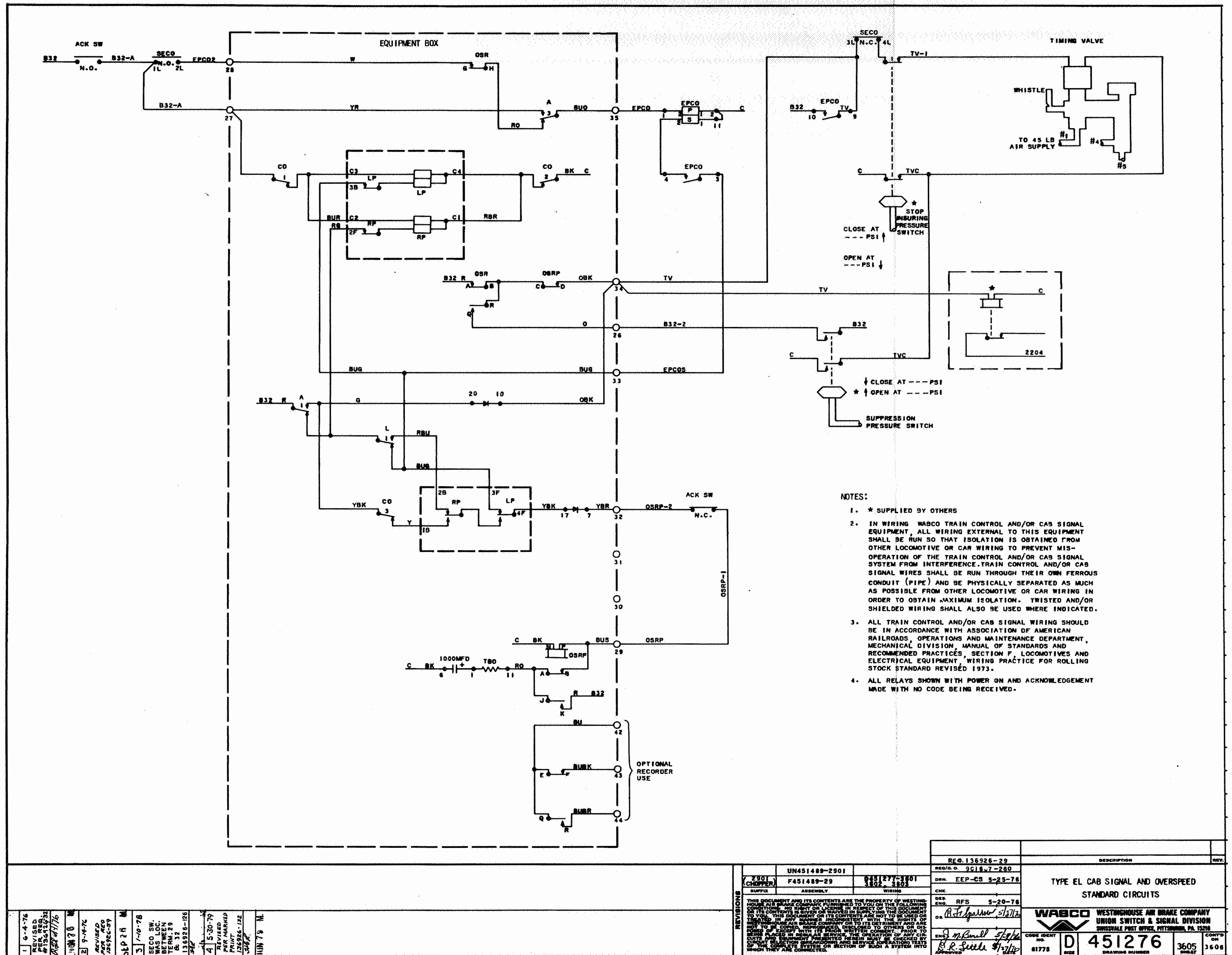
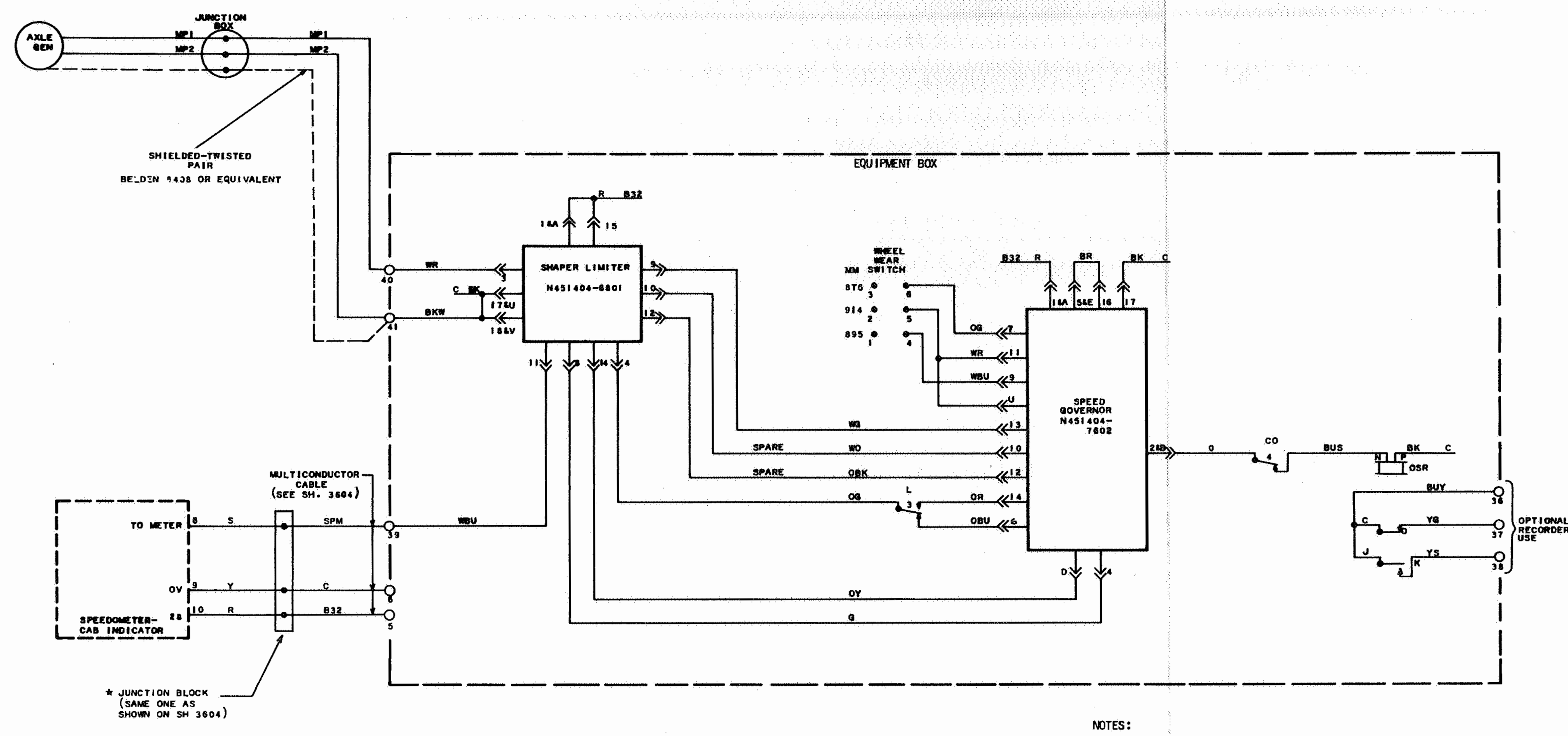


Figure 6.2B Type EL Cab Signal and Overspeed Standard Circuits (Chopper Cars)



NOTES:

1. * SUPPLIED BY OTHERS
2. IN WIRING WABCO TRAIN CONTROL AND/OR CAB SIGNAL EQUIPMENT, ALL WIRING EXTERNAL TO THIS EQUIPMENT SHALL BE RUN SO THAT ISOLATION IS OBTAINED FROM OTHER LOCOMOTIVE OR CAR WIRING TO PREVENT MIS-OPERATION OF THE TRAIN CONTROL AND/OR CAB SIGNAL SYSTEM FROM INTERFERENCE. TRAIN CONTROL AND/OR CAB SIGNAL WIRES SHALL BE RUN THROUGH THEIR OWN FERROUS CONDUIT (PIPE) AND BE PHYSICALLY SEPARATED AS MUCH AS POSSIBLE FROM OTHER LOCOMOTIVE OR CAR WIRING IN ORDER TO OBTAIN MAXIMUM ISOLATION. TWISTED AND/OR SHIELDED WIRING SHALL ALSO BE USED WHERE INDICATED.
3. ALL TRAIN CONTROL AND/OR CAB SIGNAL WIRING SHOULD BE IN ACCORDANCE WITH ASSOCIATION OF AMERICAN RAILROADS, OPERATIONS AND MAINTENANCE DEPARTMENT, MECHANICAL DIVISION, MANUAL OF STANDARDS AND RECOMMENDED PRACTICES, SECTION F, LOCOMOTIVES AND ELECTRICAL EQUIPMENT, WIRING PRACTICE FOR ROLLING STOCK STANDARD REVISED 1973.
4. ALL RELAYS SHOWN WITH POWER ON AND ACKNOWLEDGEMENT MADE, WITH NO CODE BEING RECEIVED.

REQ 136926-29	DESCRIPTION
S.O. 901607-260	TYPE EL CAB SIGNAL AND OVERSPEED STANDARD CIRCUITS
DRN. EEP-CS 5-25-76	
DES. ENG. RFS 5-20-76	
OK R. Filipović 5/27/76	WABCO WESTINGHOUSE AIR BRAKE COMPANY UNION SWITCH & SIGNAL DIVISION SWISSVALE POST OFFICE, PITTSBURGH, PA. 15218
ENG. J. M. Beil 5/27/76	CODE IDENT NO. 61775 — SIZE D — DRAWING NUMBER 451276 — SHEET 3606 — CONT'D ON 3607
APPROVED D. R. Smith 5/27/76	

Figure 6.2C Type EL Cab Signal and Overspeed Standard Circuits (Chopper Cars)

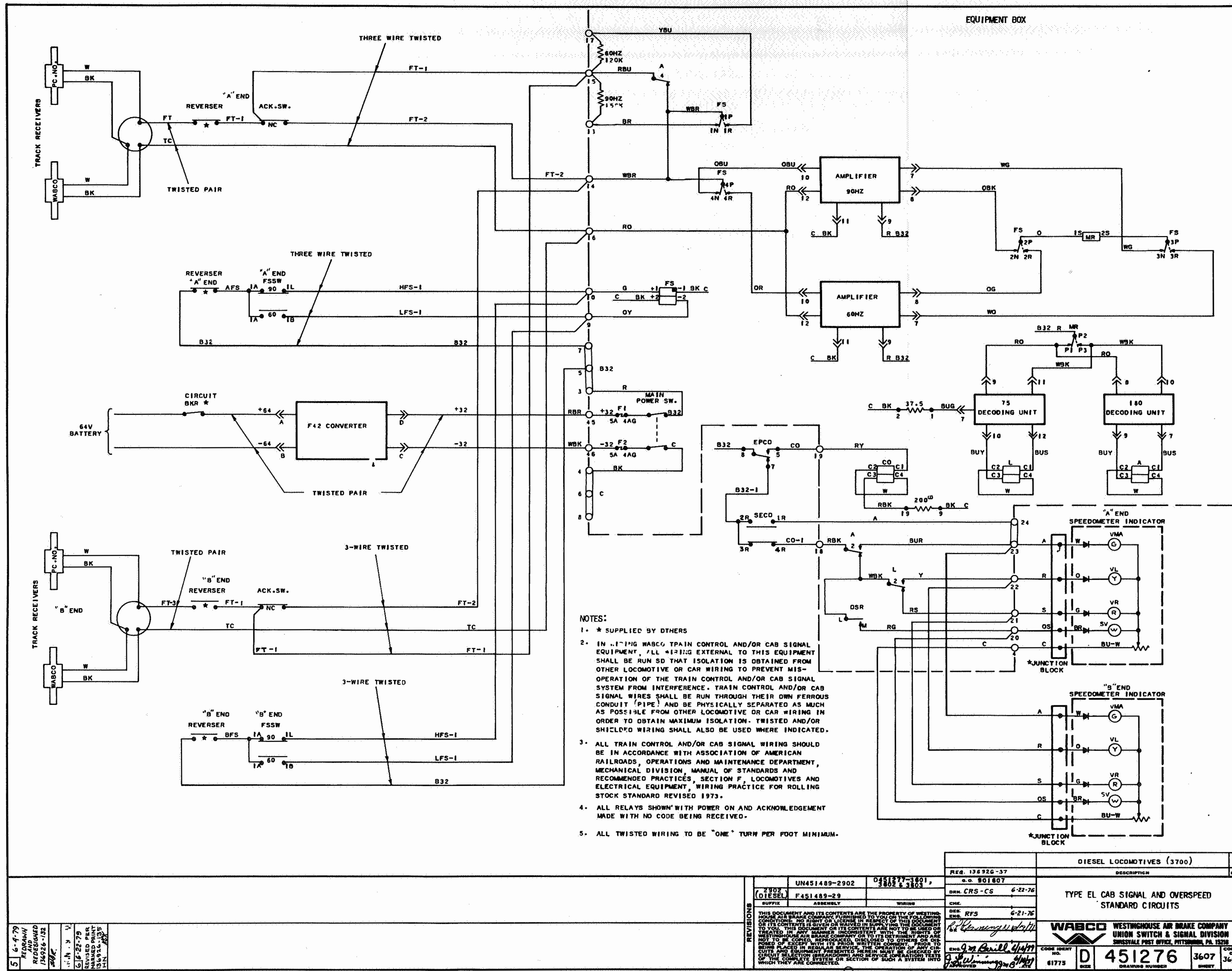


Figure 6.3A Type EL Cab Signal and Overspeed Standard Circuits (Diesel 3700)

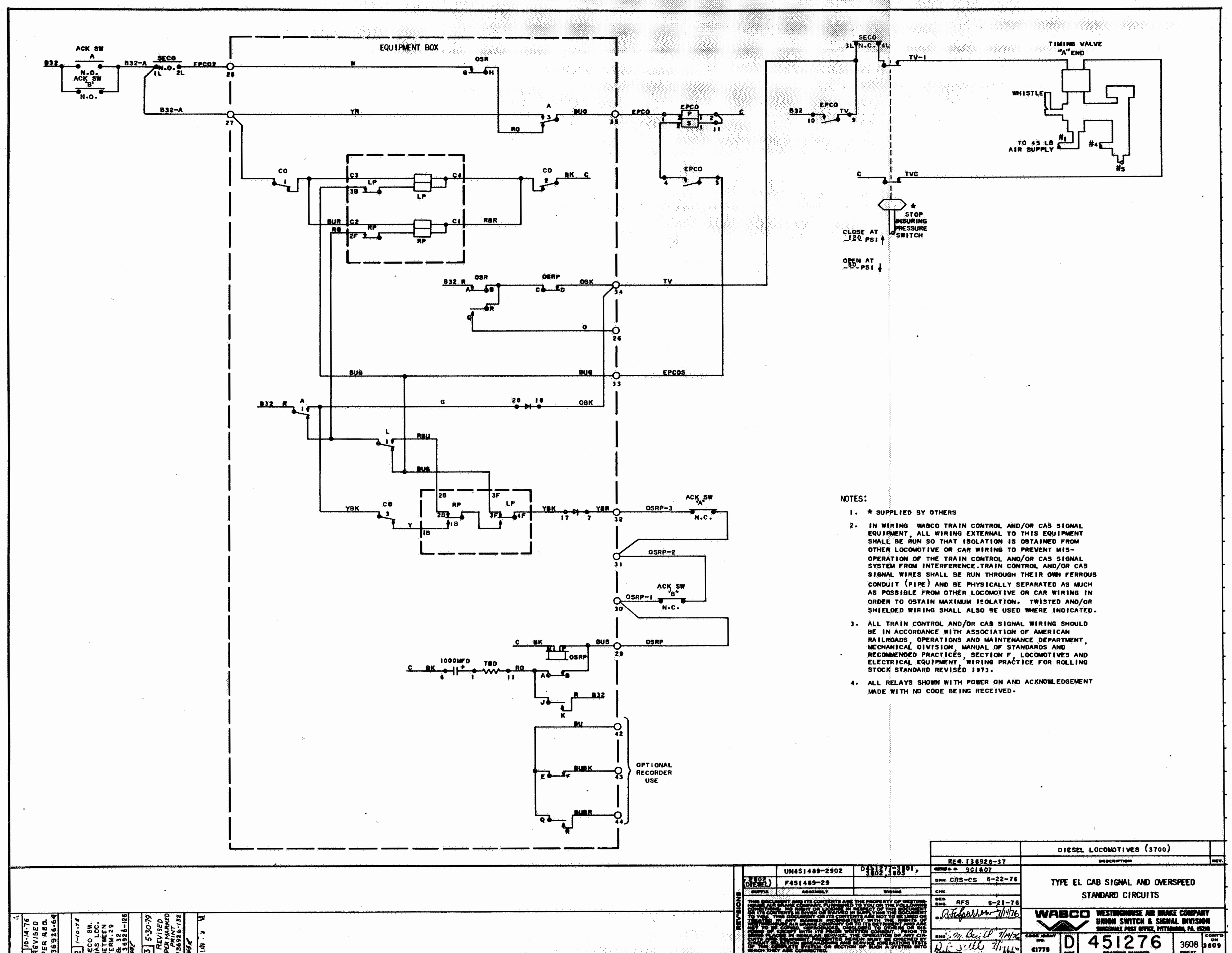


Figure 6.3B Type EL Cab Signal and Overspeed Standard Circuits
(Diesel 3700)

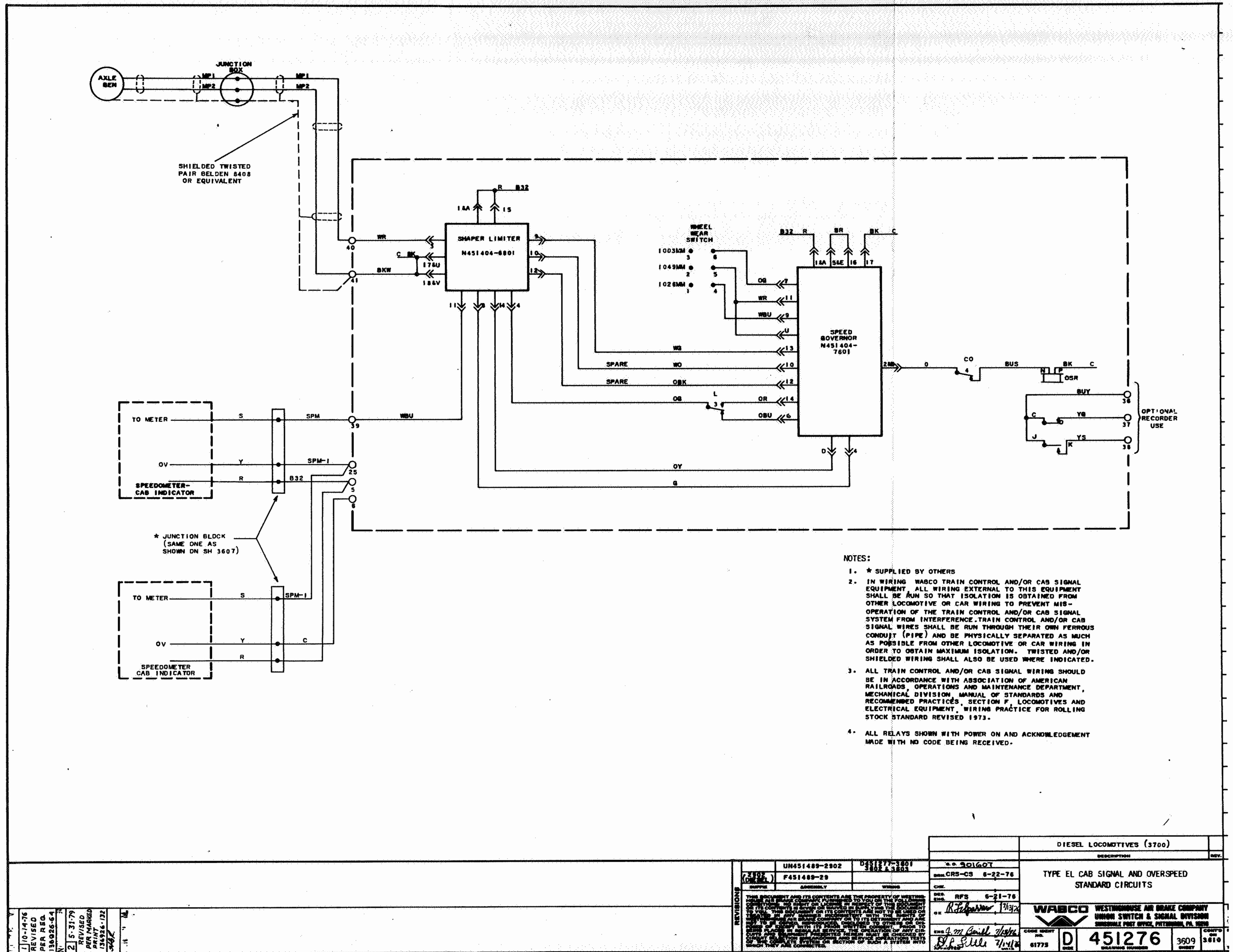


Figure 6.3C Type EL Cab Signal and Overspeed Standard Circuits (Diesel 3700)

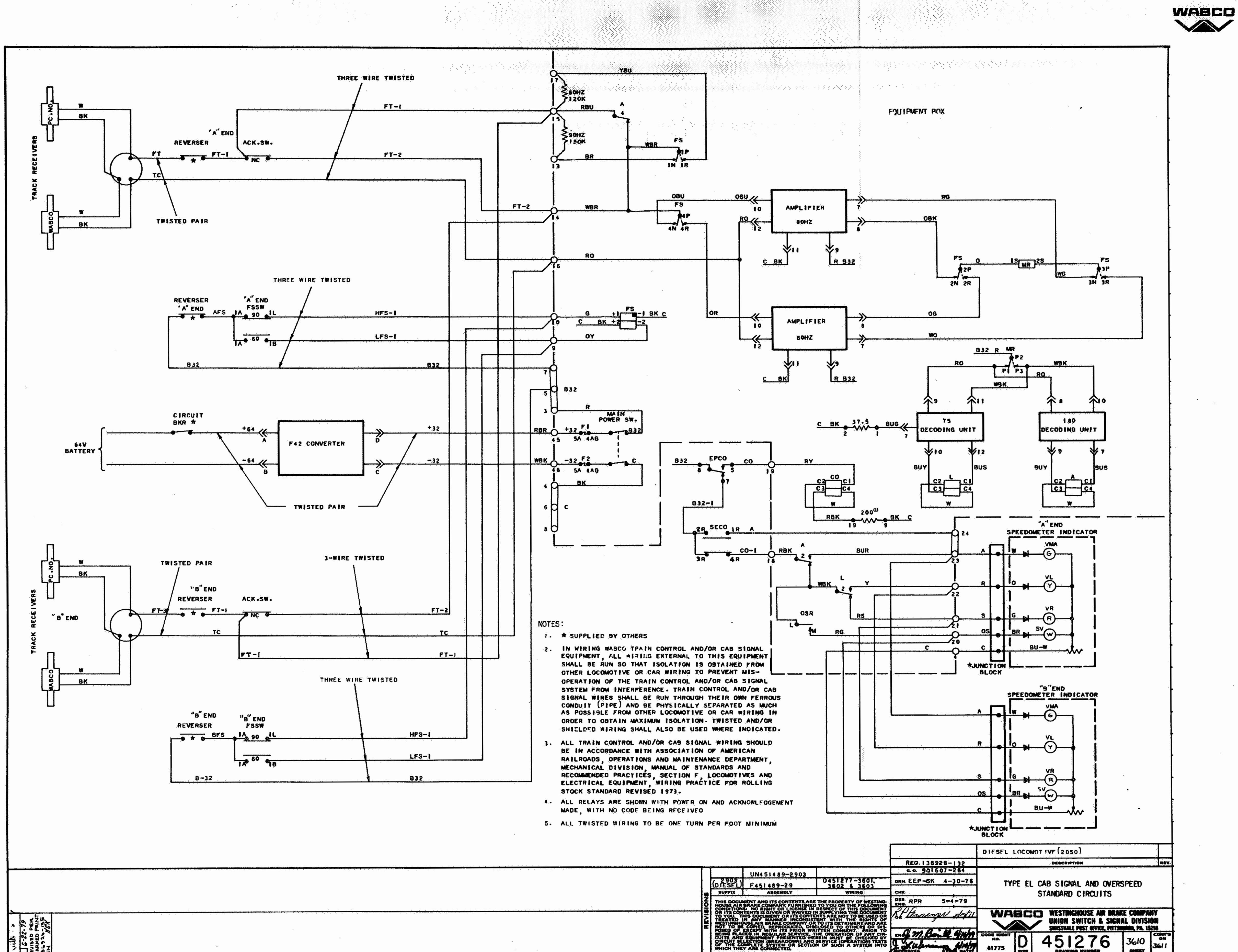


Figure 6.4A Type EL Cab Signal and Overspeed Standard Circuits (Diesel 2000 series)

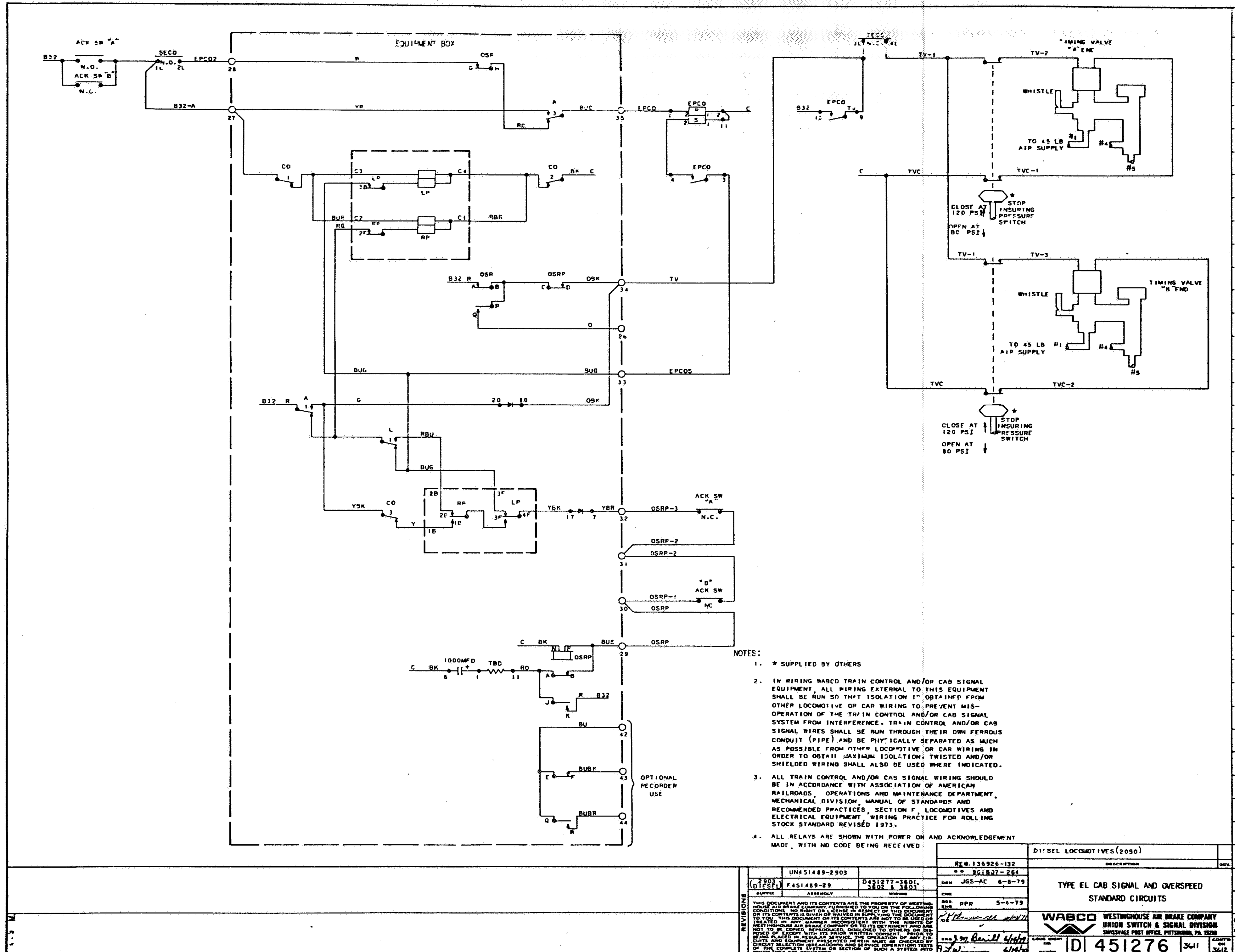


Figure 6.4B Type El Cab Signal and Overspeed Standard Circuits (Diesel 2000 series)

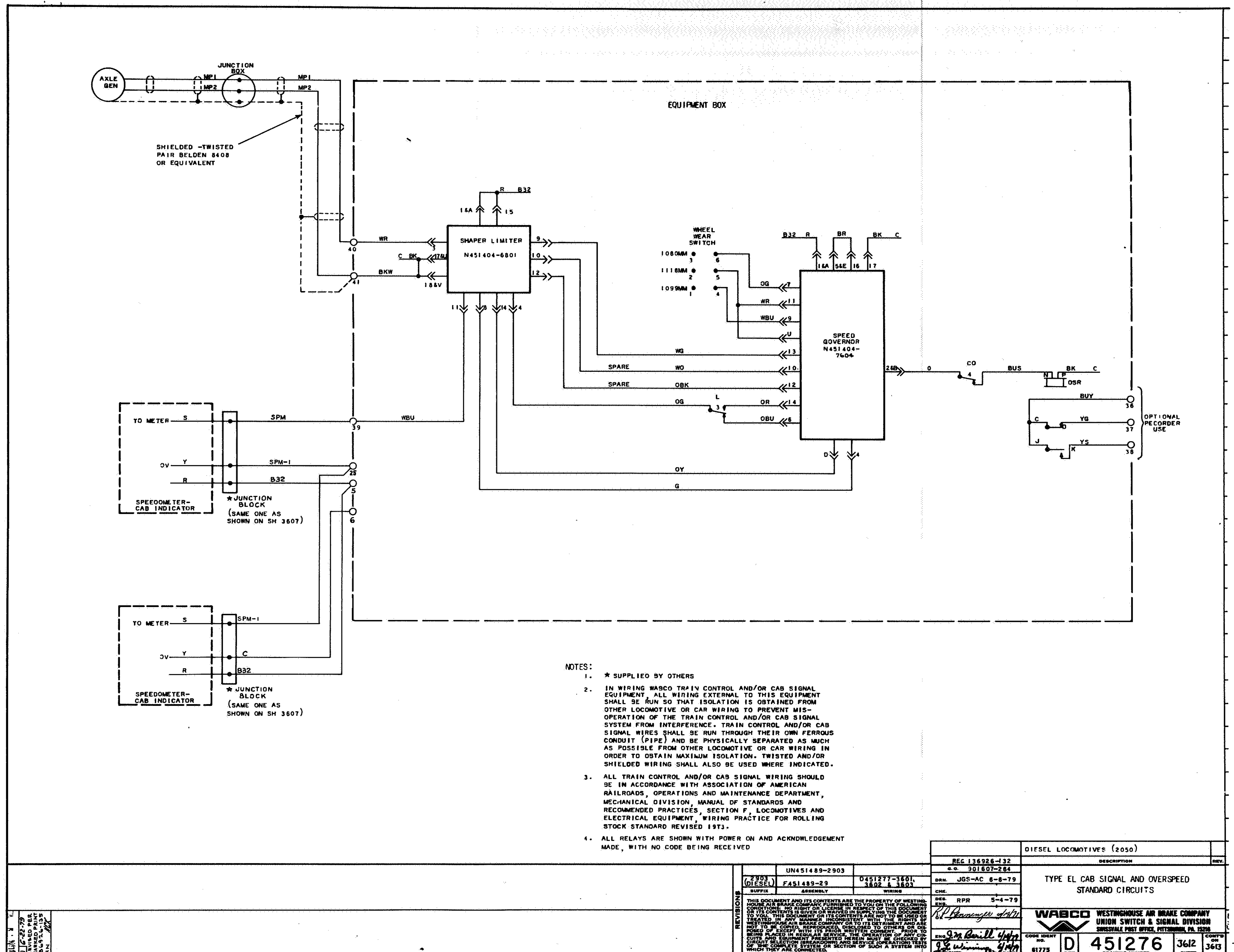


Figure 6.4C Type El Cab Signal and Overspeed Standard Circuits (Diesel 2000 series)