

**AIR / HYDRAULIC
TRAILER BRAKE SYSTEM**

Theory of Operation
and
Troubleshooting Guide

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THEORY OF OPERATION-AIR / HYDRAULIC BRAKE SYSTEM

GENERAL DESCRIPTION

The Air/Hydraulic brake actuating system derives its power solely from compressed air from the tow vehicle. The tow vehicle can have either air or hydraulic brakes but must be properly equipped to provide actuation of the trailer brakes.

The Air/Hydraulic brake actuating system consists of two basic elements: the control or synchronizing valve mounted in the engine compartment of the tow vehicle (if the vehicle has hydraulic brakes) or the foot operated control valve (if the vehicle has air brakes), and the air/hydraulic booster and air relay valve mounted on the trailer. These two elements act together so that trailer brake effort is automatically proportioned to the pedal force exerted by the driver of the tow vehicle.

Upon application of the tow vehicle brakes by the driver, the same hydraulic (or air) pressure used to apply the tow vehicle brakes is received by the control valve. The control valve creates a "control" air signal which is routed through the tractor protection valve to the control gladhand. The magnitude of the control air is dependent upon the magnitude of the hydraulic (or air) pressure input.

OPERATION-TOW VEHICLE

The components required to equip a tow vehicle to allow it to provide control of a trailer with air/hydraulic brakes are the same for vehicles with air or hydraulic brakes. The only exception is the control valve used to sense that the tow vehicle's brakes have been applied.

On a vehicle with hydraulic brakes, a hydraulic/air synchronizing valve is required. With no hydraulic input to the synchronizing valve, the valve is in its rest position and no control air is permitted to flow from the delivery port of the valve.

When the tow vehicle brakes are applied, hydraulic pressure causes the hydraulic module on the top of the valve to depress the valve diaphragm. This causes the supply air to be modulated by the hydraulic input. The resulting control air is proportional to the hydraulic input signal.

On a vehicle with air brakes, control and supply air from the existing foot control valve is used to provide control of the trailer brakes. The control air from the foot valve is proportional to the control air used to actuate the tow vehicle's brakes.

When a trailer is attached to the towing vehicle the push-pull valve on the dash is pushed in. This allows supply air to flow into the emergency line and pressurize the air tank on the trailer. The trailer brakes can be applied in one of two ways: by normally braking the tow vehicle with it's foot pedal, or by braking the trailer independently of the tow vehicle using the hand control valve on the steering column. A two-way check valve is used to route control air from either the air generated by normal braking or air from the hand control valve, whichever is greater.

The push-pull valve requires a minimum pressure (usually 40-50 psi) in order to allow supply air to flow through it. If the pressure drops below this level, the valve will automatically close which causes the brakes to be applied on the trailer.

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The tractor protection valve, generally located at the rear of the tow vehicle, is used to protect the vehicle's air system if a trailer breakaway has occurred. When the emergency line is pressurized by engaging the push-pull valve, the air acts on a diaphragm in the valve, causing it to open the service brake line. This allows the control air to pass through when the brakes are applied in the tow vehicle. If the emergency line loses air pressure, as in the case of a trailer breakaway, the valve will automatically shut, closing off the service line.

The control and the supply air are delivered from the towing vehicle to the booster/relay valve on the trailer where these relatively small pneumatic forces are boosted to much higher hydraulic pressures suitable for braking the trailer.

OPERATION-TRAILER BRAKE SYSTEM

Under normal conditions, with the trailer attached to a towing vehicle and the system fully charged, supply air pressure is present in the emergency line and atmospheric air pressure exists in the control line. Air pressure in the emergency line causes the emergency spool valve to shift into a position that allows air to flow into the air tank, charging it to full line pressure.

Control air is allowed to flow through the emergency spool valve into the control port on the top of the air relay valve. The air relay valve is actuated by the control air generated by the towing vehicle, either by the brake pedal or the hand control valve. The air relay valve then delivers air pressure, which is proportional to the braking force applied to the towing vehicle, from the air tank to the air chamber on the back of the air/hydraulic booster. The control air in the booster strokes the hydraulic piston in the master cylinder, developing hydraulic pressure in the brake lines and applying the trailer brakes. The trailer brakes are applied in proportion to the tow vehicle brakes.

The fluid reservoir on the booster exists to replenish the fluid in the system due to leakage losses and to compensate for fluid volume changes from variations in ambient temperature. A valve element within the hydraulic piston assembly provides a free fluid passage when the trailer brakes are in the released position. When the trailer brakes are applied, initial stroking of the piston serves to seal the passage and permit the development of pressure in the brake lines.

If a breakaway condition occurs, loss of pressure in the emergency line causes the emergency spool valve to shift to its rest position. This allows air to flow from the tank, through the spool valve, and into the control port of the air relay valve. The air relay valve, in turn, actuates the booster by dumping air from the reservoir tank into the air chamber on the back of the booster. This action actuates the trailer brakes and the brakes will remain on until all air has bled off from the system or the emergency line is pressurized by reconnecting the trailer to the tow vehicle. The breakaway function requires no power (either air or electric) from the towing vehicle in order to operate other than the system must be initially pressurized.

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TROUBLESHOOTING

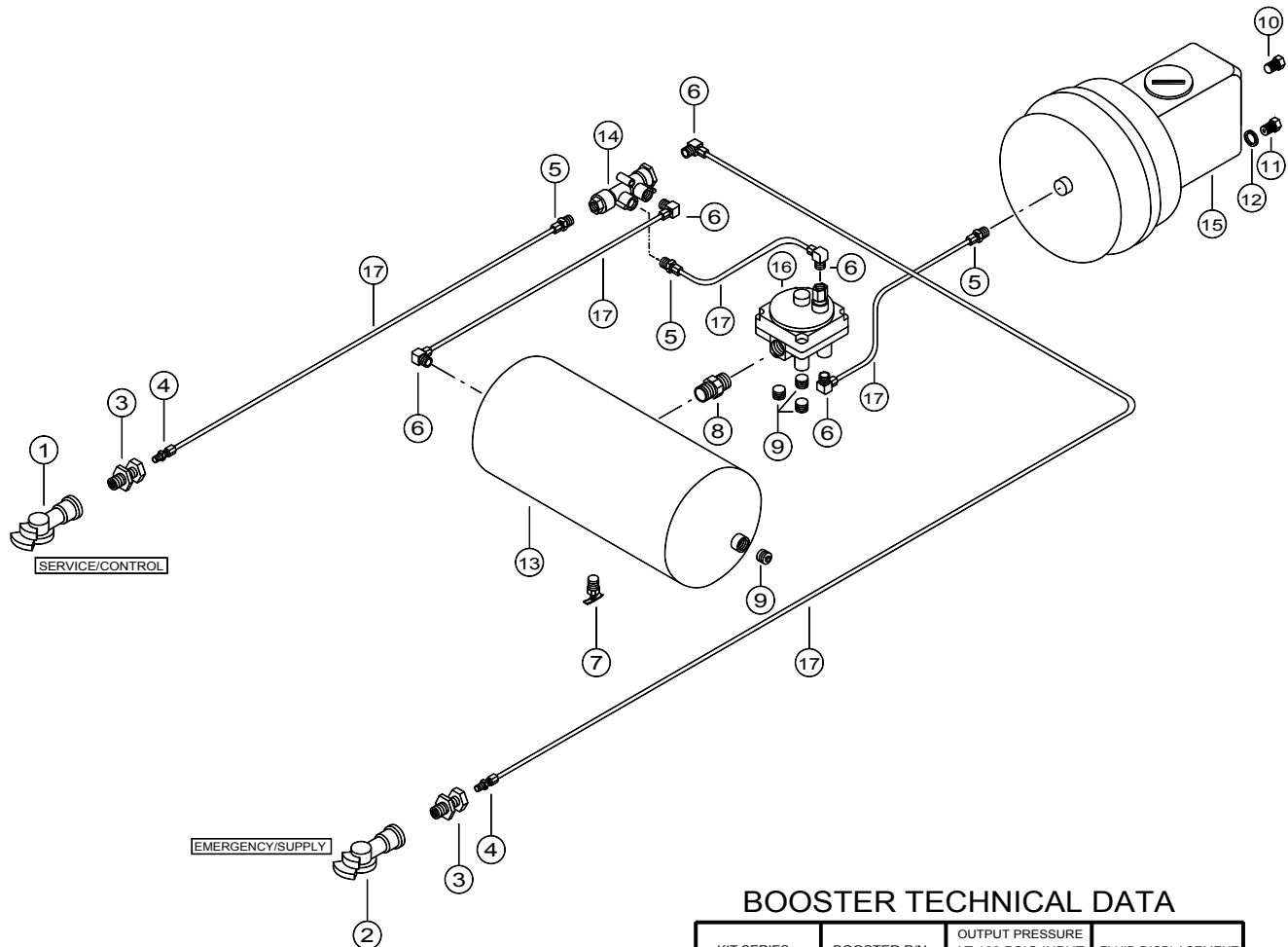
Before proceeding, assure that the tractor is functioning properly. The tractor emergency line should be at system pressure at all times if the dash control valve is set to charge the trailer. The tractor service line should be at atmospheric pressure unless either the tractor brakes have been applied or the hand control valve has been actuated.

SYMPTOM	MALFUNCTION	SOLUTION
TRAILER BRAKES LOCK AND WILL NOT RELEASE	EMERGENCY AIR LINE DISCONNECTED OR LOW PRESSURE	ASSURE AIR IN EMERGENCY LINE IS AT SYSTEM PRESSURE
	AIR PRESSURE DETECTED IN SERVICE LINE	ASSURE THAT SERVICE LINE IS AT ATMOSPHERE. IF PRESSURE IS NOTED CHECK ALL VALVES IN SYSTEM FOR FULL RELEASE
	RESTRICTION IN HYDRAULIC LINE.	ASSURE THAT ALL LINES ARE OPEN. CHECK LINES FOR KINKS, BENDS OR RESTRICTIONS.
	CALIPER OR WHEEL CYLINDER FROZEN	CHECK ALL HYDRAULIC LINES FOR BENDS, KINKS, ETC. REPAIR OR REPLACE

SYMPTOM	MALFUNCTION	SOLUTION
TRAILER BRAKES DRAG	LOW AIR PRESSURE IN EMERGENCY LINE	ASSURE AIR IN EMERGENCY LINE IS AT SYSTEM PRESSURE
	AIR PRESSURE DETECTED IN SERVICE LINE	ASSURE THAT SERVICE LINE IS AT ATMOSPHERE. IF PRESSURE IS NOTED CHECK ALL VALVES IN SYSTEM FOR FULL RELEASE
	RESTRICTION IN HYDRAULIC LINE.	ASSURE THAT ALL LINES ARE OPEN. CHECK LINES FOR KINKS, BENDS OR RESTRICTIONS.
	CALIPER OR WHEEL CYLINDER FROZEN	CHECK ALL HYDRAULIC LINES FOR BENDS, KINKS, ETC. REPAIR OR REPLACE

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SYMPTOM	MALFUNCTION	SOLUTION
TRAILER BRAKES WON'T APPLY	NO AIR PRESSURE IN SERVICE LINE	ASSURE AIR DELIVERY TO SERVICE GLADHAND. ASSURE SERVICE AIR IS DELIVERED TO CONTROL VALVE.
	NO AIR PRESSURE OUT OF RELAY VALVE	REPLACE VALVE IF SERVICE AIR IS REACHING CONTROL PORT.
	LOW OR NO AIR PRESSURE IN EMERGENCY LINE	ASSURE AIR IN EMERGENCY LINE IS AT SYSTEM PRESSURE. ASSURE THAT EMERGENCY AIR IS CHARGING SYSTEM RESERVOIR.
	RESTRICTION IN SERVICE OR EMERGENCY LINE.	ASSURE THAT ALL LINES ARE OPEN. CHECK LINES FOR KINKS, BENDS OR RESTRICTIONS.
	RESTRICTION IN HYDRAULIC LINE.	CHECK ALL HYDRAULIC LINES FOR BENDS, KINKS, ETC.
	CALIPER OR WHEEL CYLINDER FROZEN	REPAIR OR REPLACE
	BOOSTER OUT OF FLUID	FILL FLUID RESERVOIR TO PROPER LEVEL
	EXCESSIVE AIR IN HYDRAULIC SYSTEM	REBLEED TRAILER HYDRAULIC SYSTEM
	BOOSTER WORKS BUT PRODUCES NO HYDRAULIC OUTPUT	HYDRAULIC PISTON HAS MALFUNCTIONED. REPAIR OR REPLACE MASTER CYLINDER
BRAKE PADS OR SHOES WORN OUT	REPLACE PADS OR SHOES	



BOOSTER TECHNICAL DATA

KIT SERIES	BOOSTER P/N	OUTPUT PRESSURE AT 100 PSIG INPUT	FLUID DISPLACEMENT
TH-800	AB-800	750 PSIG	3.45 cu. in.
TH-1000	AB-1000	1000 PSIG	2.65 cu. in.
TH-1200	AB-1200	1250 PSIG	2.65 cu. in.
TH-1400	AB-1400	1000 PSIG	3.60 cu. in.
TH-1500	AB-1500	1500 PSIG	2.65 cu. in.

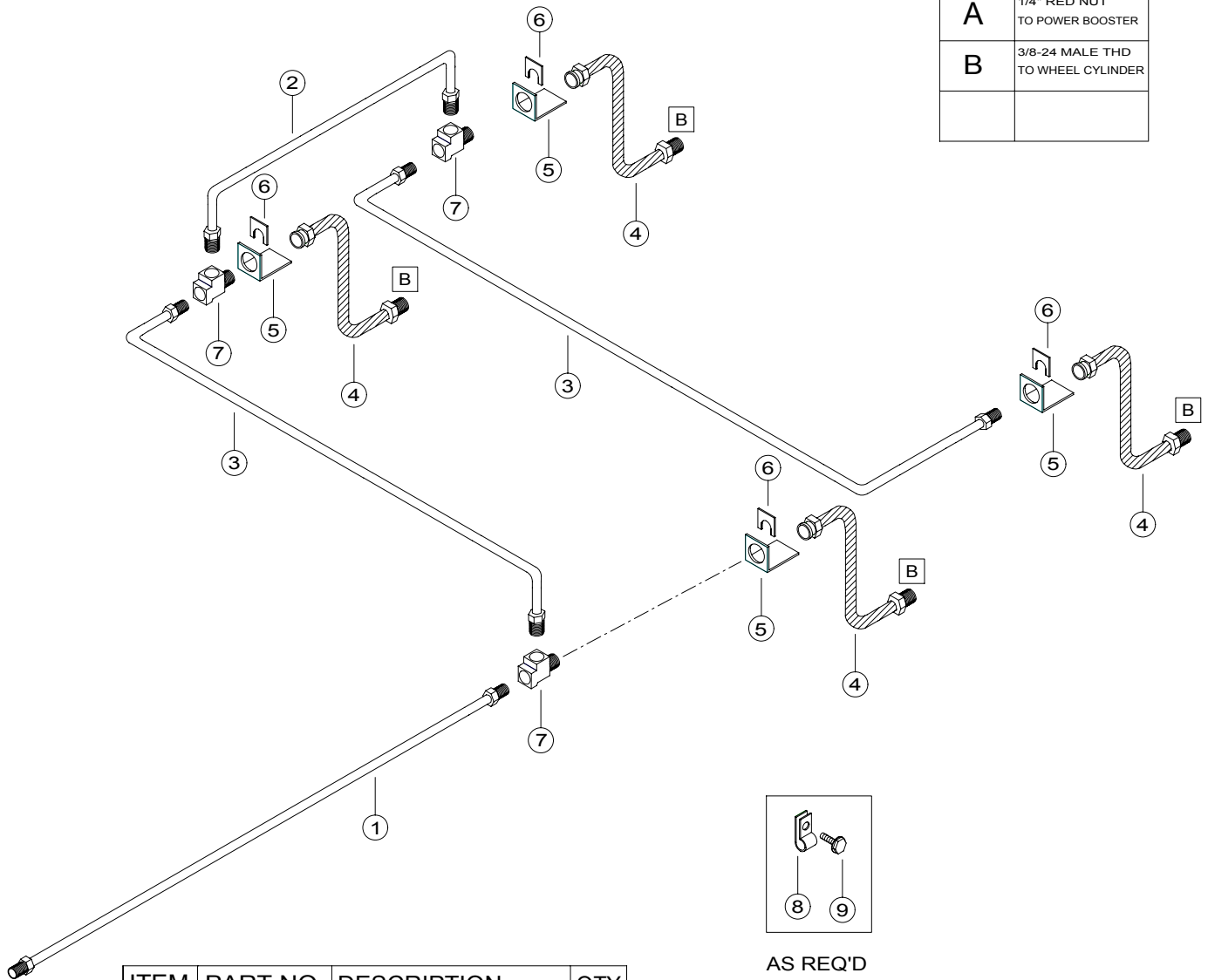
ITEM	PART NO.	DESCRIPTION	QTY
1	78850	GLADHAND-SERVICE	1
2	78851	GLADHAND-EMERGENCY	1
3	5499	1/2" BULKHEAD COUPLING	2
4	1468X6	3/8 X 1/4 MALE CONNECTOR	2
5	1468X6X6	3/8 X 3/8 MALE CONNECTOR	3
6	1469X6X6	3/8 X 3/8 MALE ELBOW	5
7	C-145	1/4" DRAIN VALVE	1
8	3069X12	3/4" HEX NIPPLE	1
9	3159X6	3/8" PIPE PLUG	4
10	7237X5	5/16" PLUG	1
11	7829	5/16" X 1/4" ADAPTER	1
12	8154	COPPER GASKET	1
13	AT1488	AIR TANK-1488 CU IN	1
14	EM1103	EMERGENCY SPOOL	1
15	ABXXX	AIR/HYDRAULIC BOOSTER	1
16	RV9250	AIR RELAY VALVE	1
17	NT10006BK	3/8" OD AIR BRAKE TUBING	25 FT
18			

AIR/HYDRAULIC BRAKE ACTUATING KIT

SCALE: NONE	DRAWING NUMBER
DATE: 122899	TH-2000

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ITEM	REMARK
A	1/4" RED NUT TO POWER BOOSTER
B	3/8-24 MALE THD TO WHEEL CYLINDER



ITEM	PART NO.	DESCRIPTION	QTY
1	T-16300-C-1R	3/16" X 25 FT BRAKE LINE	1
2	T-16051-C	3/16" X 51" BRAKE LINE	1
3	T-16060-C	3/16" X 60" BRAKE LINE	2
4	18018-MF	18" HYD. BRAKE HOSE-ML/FML	4
5	25X15	FRAME/HOSE BRACKET	4
6	1457	HOSE CLIP	4
7	7900	3/16" IF STREET TEE	3
8	G-4	TUBE CLAMP	8
9	11832	SELF-TAP SCREW	8
10			
11			
12			
13			
14			
15			
16			
17			
18			

**BRAKE LINE KIT,
TANDEM AXLE , TORSION**

SCALE: NONE	DRAWING NUMBER
DATE: 121791	T-1002T

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