AIR
RESEARCH
COMPRESSORS

1809/1310 BOOSTER COMPRESSOR

OPERATION MANUAL

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SECTION 1 – SAFETY

1.1 GENERAL

Air Research Compressor designs and manufactures its products so they can be operated safely. However, the responsibility for safe operation rests with those who use and maintain our products. The following safety precautions are offered as a guide, which, if conscientiously followed, will minimize the possibility of accidents throughout the useful life of this equipment.

Only those who have been trained and delegated to do so, and who have read and understand this operator's manual should operate this booster compressor (Hereafter referred to as "booster"). Failure to follow the instructions, procedures and safety precautions in this manual, or misuse of the booster, even though not expressly mentioned herein, can result **in accidents, injuries or death, property damage, and/ or mechanical failure, for which Air Research Compressors cannot be held responsible.**

Never start this booster unless it is safe to do so. Do not attempt to operate the booster with a known unsafe condition. Tag the booster so others who may not know of the unsafe condition will not attempt to operate it until he condition is corrected.

Use and operate this booster only in full compliance with all pertinent O.H.S.W. requirements and all pertinent Federal, State and Local Codes or Regulations.

Do not disconnect or alter safety shutdown sensors or swichgages. Do not modify this booster except with written factory approval. Unauthorized modifications may void warranty terms and conditions.

1.2 PRESSURE RELEASE

A. Inspect the pressure relief valves at least weekly to make sure they are not blocked, closed, obstructed or otherwise disabled. Do not adjust the pressure relief valves.

B. Install an appropriate flow limiting valve between the booster discharge valve and the discharge hose, to reduce pressure in case of hose failure, per Health and Safety requirements.

C. When the hose is to be used to supply a manifold, install an additional appropriate flow limiting valve between the manifold and each shut-off (throttle) valve that is to be connected to an air hose, to reduce pressure in case of hose failure.

D. Provide an appropriate flow limiting valve for each additional 23 metres (75 feet) of hose, to reduce pressure in case of hose failure.

E. Flow limiting valves are listed by pipe size and flow rates. Select appropriate valves accordingly.

F. A maximum pressure *1809 8V92T* of 6207 (900 psig) *1310 8V9*2T 6895 kPa (1000 psig) may occur at the discharge valve of this booster, under certain circumstances. Select tools, air hoses, pipes, valves, filters and other fittings accordingly. Do not exceed manufacturer's rated safe operating pressures, for these items.

G. It is recommended a 50mm (2"), 2758 kPa (400 psig) min operating pressure hose be used for the inlet and a 40mm (1½"), 6895 kPa (1000 psig) min operating pressure hose be used for the discharge, to prevent restricted flow and protect against over pressurization.

H. Vent all internal pressure prior to opening, servicing or disconnecting any line, fitting, hose, valve, drain plug, connection, or other component, or before staring the booster.

I. Keep personnel out of line with and away from the discharge opening of hoses, tools, or other points of compressed air discharge.

J. Do not use air at pressures higher than 207 kPa (30 PSIG) for cleaning purposes, and then only with personal protective equipment, per Health and Safety requirements.

K. Do not engage in horseplay with air hoses, as death or serious injury may result.

L. Do not remove radiator filler cap until the cooling temperature is below its boiling point. Then loosen cap slowly to its stop to relieve any excess pressure, and make sure coolant is not boiling before removing cap completely.

1.3 FIRE AND EXPLOSION

A. Refuel at a service station or from a fuel tank designed for its intended purpose. If this is not possible, ground the machine to the dispenser prior to refueling.

B. Clean up spills of fuel, oil, or coolant immediately when such spills occur.

C. Shut off the booster and allow it to cool. Then keep sparks, flames and other sources of ignition away, and do not permit smoking in the vicinity when adding fuel, or when checking or adding electrolyte to the batteries, or when checking or adding oil.

D. Do not permit liquids or oil film, to accumulate on any external or internal surfaces of the booster. Wipe down using an aqueous industrial cleaner or steam clean as required. Do not use flammable solvents for cleaning purposes.

E. Disconnect the grounded (negative) battery connection prior to attempting any repairs.

F. Keep electrical wiring, including the battery terminals and other terminals in good condition. Replace any wiring that has cracked, cut, abraded or otherwise degraded insulation; or terminals that are worn, discoloured, or corroded. Keep all terminals clean and tight.

G. Keep grounded conductive objects such as tools away from exposed live electrical parts such as terminals to avoid arcing, which might serve as a source of ignition.

H. Replace damaged fuel tanks or lines immediately rather than attempting to weld or otherwise repair them. Do not store or attempt to operate this booster with any known leaks in the fuel system.

I. Remove any material that may be damaged by heat or that may support combustion and is in close proximity, prior to attempting weld repairs.

J. Keep a suitable class, fully charged fire extinguisher, or extinguishers, nearby when servicing and operating the booster.

K. Keep oil rags, rubbish, leaves, litter or other combustibles out of and away from the booster.

L. Turn off battery charger before making or breaking connections to the battery.

M. Do not operate the booster under low overhanging leaves, or permit such leaves to contact hot exhaust system surfaces when operating the booster in forested areas.

1.4 MOVING PARTS

A. Keep hands, arms and other parts of the body, and also clothing away from belts, pulleys and other moving parts.

B. Do not attempt to operate the booster with the fan guard removed.

C. Wear snug fitting clothing and confine long hair when working around this booster.

D. Make sure all personnel are clear of the booster prior to attempting to start or operate it.

E. Shut off engine before adding fuel, oil, coolant, lubricants, and battery electrolyte.

F. Disconnect the grounded negative battery connection to prevent accidental engine operation prior to attempting repairs or adjustments.

G. Make adjustments only when the engine is shut off. When necessary, make adjustment, and then start engine to check adjustment. If adjustment is incorrect, shut off engine, readjust, then restart engine to recheck adjustment.

Note: This does not apply to booster control system adjustments.

H. Keep hand, feet, floors and controls clean free of oil, water, antifreeze or other liquids to prevent slips and fails.

1.5 HOT SURFACES, SHARP EDGES AND SHARP CORNERS

A. Avoid bodily contact with hot oil, hot coolant, hot surfaces and sharp edges and corners.

B. Keep all parts of the body away from all points of air discharge and away from hot exhaust gases.

C. Wear personal protective equipment, including gloves and head covering, when working in, on, or around this booster.

D. Keep a first aid kit handy. Seek medical assistance promptly in case of injury.
Don’t ignore small cuts and burns. They may lead to infection.

1.6 TOXIC AND IRRITATING SUBSTANCES

A. Do not use air from this booster for respiration or food processing except in full compliance with Health and Safety requirements and any other Federal, State or Local Codes or Regulations.

B. Operate the booster only in open or well ventilated areas.

C. If the machine is operated indoors, discharge engine exhaust fumes outdoors.

D. Locate this booster so that exhaust fumes are not apt to be carried towards personnel, air intakes servicing personnel areas, or towards the air intake of the booster.

E. Fuels. Oils, coolants, lubricants and battery electrolyte used in this booster are typical of the industry. Care should be taken to avoid accidental ingestion and skin contact. In the

event of ingestion seek medical treatment promptly. Do not induce vomiting if fuel is ingested. Wash with soap and water in the event of skin contact.

F. Wear an acid resistant apron and a face shield or goggles when servicing the battery. If electrolyte is spilled on skin or clothing immediately flush with large quantities of water.

1.7 ELECTRICAL SHOCK

A. Keep the towing vehicle or equipment carrier, booster, hoses, tools and all personnel at least 3 metres (10 feet) from power lines and buried cables.

B. Keep all parts of the body and any hand held tools or other conductive objects away from exposed live parts of the electrical system. Maintain dry footing, stand on insulating surfaces and do not contact any other portion of the booster when making adjustments or repairs to exposed live parts of the electrical system.

C. Attempt repairs only in clean, dry well lighted and ventilated areas.

1.8 LIFTING

A. Lift only by:
Forklift tine access mounts.
Or, lifting eyes when provided.

B. Inspect lifting eyes and points of attachment for cracked welds and for cracked, bent, corroded or otherwise degraded members prior to lifting.

C. Make sure entire lifting rigging and supporting structure has been inspected, is in good condition, and has a rated capacity of the lifted weight.

D. Make sure lifting hooks have a functional safety latch, or equivalent, and are fully engaged and latched on the lifting eyes.

E. Use guide ropes or equivalent to prevent twisting or swinging.

F. Do not attempt to lift in high winds.

G. Keep all personnel out from under and away from the booster when it is suspended.

H. Lift booster no higher than necessary.

I. Keep lift operator in constant attendance whenever booster is suspended.

J. Set booster down only on level surfaces capable of supporting its known weight.

K. Make sure park brakes are set and block both sides of all wheels prior to disengaging the lifting hooks. (Not applicable to skid or truck mounted models.)

1.9 JUMP STARTING

A. Observe all safety precautions mentioned elsewhere in this manual.

B. The batteries may contain hydrogen gas which is flammable and explosive. Keep flames, spark and other sources of ignition away.

C. The batteries contain acid which is corrosive. Do not allow battery acid to contact eyes, skin, fabrics, or pained surfaces, as serious personal injury or property damage could result. Flush any contacted areas thoroughly with water immediately. Wear an acid resistant apron and face shield when attempting to jump-start the booster.

D. Remove all vent caps from both batteries in the booster. Do not permit dirt or foreign matter to enter the open cells.

E. Check fluid level. If low, bring fluid to proper level before attempting to jump-start.

F. Do not attempt to jump-start if fluid is frozen or slushy. Bring the batteries up to at least 4.4°C (40°F) before attempting to jump-start.

G. Cover open cells of the booster battery with clean dampened cloths before attempting to jump-start.

H. Attempt to jump-start only with vehicle having a 24volt electrical system with NEGATIVE GROUND that is equipped with a battery, or batteries, of comparable size or larger. Do not attempt to jump start using motor generator sets, welders or other sources of DC power as serious damage may result.

I. **DO NOT** use 2 sets of cables to jump both batteries at once. This will short out both of the batteries in the 24volt system. This could cause the batteries to explode unless you use 2 different source systems which have no common connections.

J. Bring the starting vehicle alongside the booster, but do not permit metal to metal contact between the booster and the starting vehicle.

K. Set the parking brakes of both the booster and the starting vehicle, or otherwise block both front and rear of all wheels. (Not applicable to skid or truck mounted models.)

L Place the starting vehicle in neutral or park, turn off all non-essential accessory electrical loads, and start its engine.

M. Use only jumper cables that are clean, in good condition and are heavy enough to handle the starting current.

N. Avoid accidental contact between jumper cable terminal clips or clamps and any metallic portion of either the booster or the starting vehicle to minimize the possibility of uncontrolled arcing which might serve as a source of ignition.

O. Positive battery terminals are usually identified by a plus (+) sign and/ or the letters POS adjacent to the terminal. Negative battery terminals are usually identified by a negative (-) sign and/ or the letters NEG adjacent to the terminal.

P. Connect one end of a jumper cable to the positive (POS) (+) battery terminal in the starting vehicle.

Q. Connect the other end of the same jumper cable to the positive (POS) (+) battery terminal in the booster.

R. Connect one end of the other jumper cable to the negative (NEG) (-) battery of the starting vehicle.

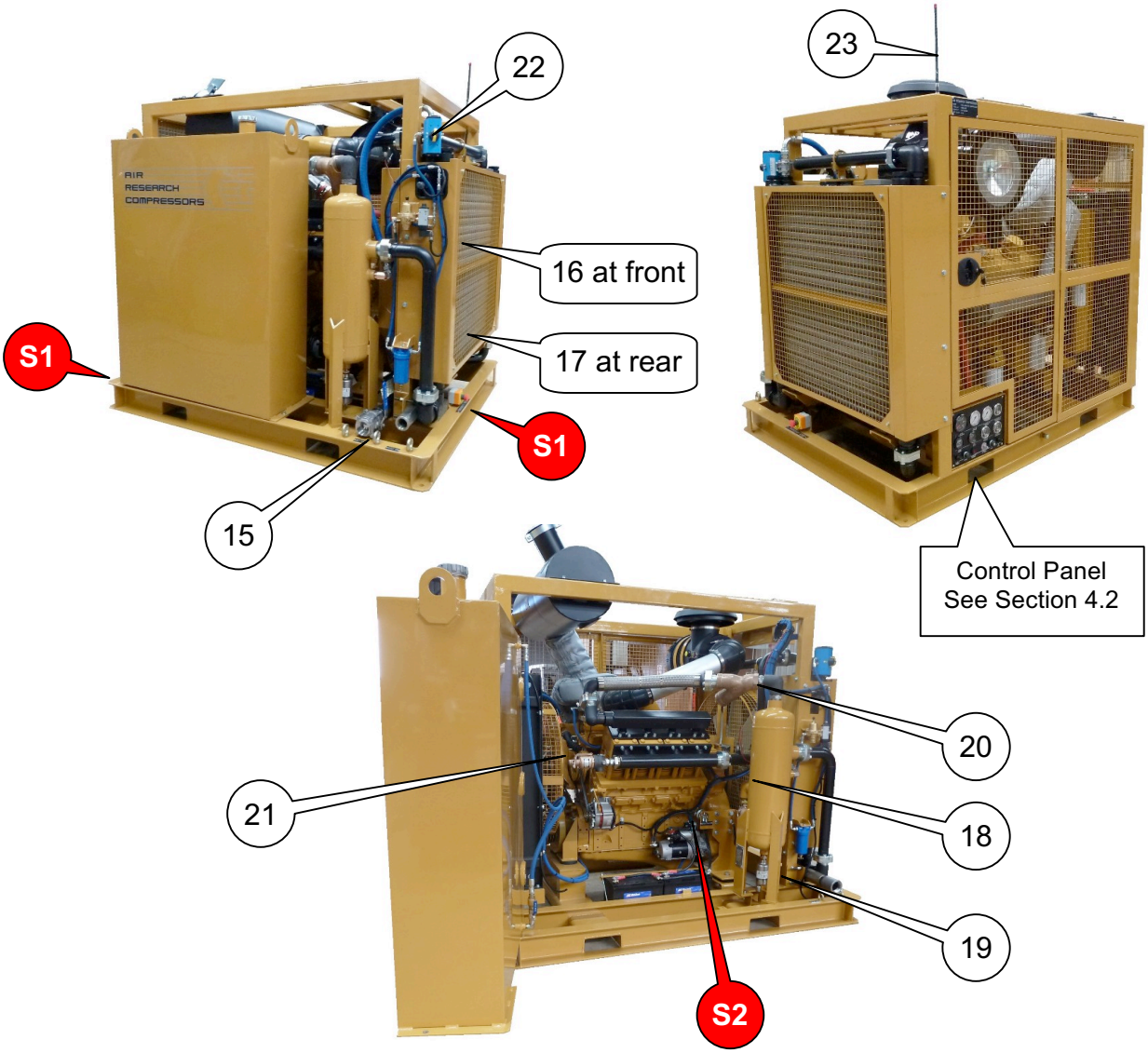
S. Check your connections.

T. Connect the other end of this same jumper cable to a clean portion of the booster engine block away from fuel lines, the crank case breather opening, and the battery.

U. Start the booster in accordance with normal procedure. Avoid prolonged cranking.

V. Allow the booster to warm up. When the booster is warm and operating smoothly at normal idle RPM, disconnect the jumper cable from the engine block in the booster, then disconnect the other end of this same cable from the negative (NEG) (-) battery terminal in the starting vehicle. Disconnect the other jumper cable from the positive (POS) (+) battery terminal in the booster and finally disconnect the other end of this same jumper cable from the positive (POS) (+) battery terminal in the starting vehicle.

W. Remove and carefully dispose of the dampened cloths as they be contaminated with acid, then replace all vent caps.



SECTION 2 – DESCRIPTION

Figure 1

2.1 INTRODUCTION

Model 1809 8V92T is an integral engine booster compressor that is designed to deliver pressures up to 6207 kPa (900 psig) while using inlet capacities up to 1800 acfm and holding inlet pressures up to 2413 kPa (350 psig).

Model 1310 8V92T is an integral engine booster compressor that is designed to deliver pressures up to 6897 kPa (1000 psig) while using inlet capacities up to 1300 acfm and holding inlet pressures up to 2413 kPa (350 psig).

To prevent excess temperature the compression ratio should be not exceed 3:1 while holding inlet pressures below 2068 kPa (300 PSIG). For capacities, inlet pressures and maximum discharge pressures, see chart 3.2, page 13.

NOTE: THE BOOSTER WILL INCREASE THE PRESSURE ACCORDING TO THE DOWNSTREAM RESISTANCE BUT WILL NOT ADD ANY ADDITIONAL CAPACITY. THE MACHINE MUST ALWAYS BE USED WITH AIR COMPRESSORS OF THE CORRECT CAPACITY TO MAINTAIN THE CORRECT INLET PRESSURE.

2.2 DESCRIPTION OF COMPONENTS

No	*Component*	*Description*
S1	EMERGENCY STOP BUTTON	Shuts off power, stops engine
S2	BATTERY ISOLATOR SWITCH (Lockable)	Isolates all power to compressor from battery.
15	SERVICE VALVES	The booster is provided with a 50mm (2") BSP inlet valve and a 40mm (1½") BSP discharge valve to allow independent control of the booster. With the inlet and discharge valves closed and all pressure vented from the machine, the booster may be started and warmed up with no load on the engine. This procedure is described in SECTION 4.4, START UP PROCEDURE.
16	PRECOOLER	An air to air Precooler is provided to cool the inlet air to prevent excessive temperatures during the booster compression process. The compressor providing the air must have a good air cooling system or Aftercooler as the inlet air temperature should be below 121°C (250°F).
17	AFTERCOOLER	After compression in the booster, the air passes through an air to air Aftercooler for final cooling.
18	INLET RELIEF VALVE	A 25mm (1"), 2930 kPa (425 psig) relief valve is provided on the inlet side to prevent over pressurization of the inlet system.
19	SCRUBBER TANK OR MOISTURE SEPARATOR	After the Precooler a Scrubber tank or moisture separator is provided to remove any moisture and oil from the air stream. Drain valve is provided to regularly drain the accumulated moisture and oil.
20	INLET STRAINER	An inlet strainer is located after the Scrubber tank to strain any particles, which may have entered the air stream during hose connection, and prevent them from entering the booster cylinders.
21	DISCHARGE RELIEF VALVE	A 20mm (¾"), 7239 kPa (1050 psig) relief valve is provided on the discharge side to prevent over pressurization of the discharge system.
22	AUTO BYPASS VALVE	An automatic bypass valve is provided between the Aftercooler and the Scrubber tank. It is setup to automatically open during periods in bypass mode, and close during periods in boost mode.
23	BYPASS REMOTE CONTROL	Bypass remote controls system including a 2 channel receiver with 2 transmitters configured with 2 button control. 1) Emergency Stop. 2) Bypass Mode
23V	BYPASS REMOTE CONTROL VALVE	Bypass remote pneumatic control configured to actuating Bypass Mode

2.3 INSTRUMENT PANEL GROUP – FUNCTIONAL DESCRIPTION

The Instrument Panel Group consists of a panel containing an engine water temperature swichgage, engine oil pressure swichgage, voltmeter, tachometer, hourmeter, discharge air pressure gauge, discharge air temperature swichgage, "on/off" switch, starter switch, override switch, and fuse.

Refer to figure 2- for locations of the following indicators and controls:

- The engine water temperature swichgage is connected to the engine at an access port that allows it to sense the temperature of the engine's cooling water. This gauge continually monitors the temperature of the cooling water during operation. The normal reading should be approximately 71 - 99°C
(160 - 210°F). If the temperature exceeds 99°C (210°F), the contacts in the swichgage will activate the shutdown system and cut the fuel solenoid signal.

- The engine oil pressure swichgage monitors the engine oil pressure from the moment the machine is started. It is essential that the proper oil pressure be maintained. The proper oil pressure reading should be approximately 345 – 551 kPa (50 – 80 PSIG) at 1800 rpm. If the oil pressure falls below 138 kPa (20 PSIG), the contacts in the swichgage will activate the shutdown system and cut the fuel solenoid signal.

- The voltmeter indicates the performance of the electrical charging system. Upon starting the engine, the needle should move about 29 volts; however, the needle should fall back to about 26.4 volts after the engine has run for a few minutes. The voltmeter should never indicate a reading below 24 volts while the engine is running, as this indicates that the alternator is not charging.

- The tachometer indicates the engine speed. The engine should operate between 1400 rpm and 1800 rpm during boost mode, and 850 rpm during bypass mode.

- The hourmeter indicates the accumulative hours of booster operation. This is useful for planning and logging service operations. Refer to section 5 for recommended service intervals.

- The inlet air pressure gauge continually monitors the inlet pressure at various load and unload conditions.

- The discharge air pressure gauge continually monitors the discharge pressure at various load and unload conditions.

- The discharge air temperature swichgage is connected to the discharge manifold. This gauge continually monitors the temperature of the discharge air before cooling. If the temperature exceeds 200°C (392°F) the contacts in the swichgage will activate the shutdown system and cut the fuel solenoid signal.

- The "on/off" switch is used to energize the machine's electrical system and is placed in the "off" position to shut the machine down. This switch must be in the "on" position before the engine can be started.

- The starter switch is depressed when starting the booster and must be released as soon as the engine starts running.

- The override switch is depressed at the same time the starter button is depressed. The switch allows the electrical circuit to bypass the engine oil pressure when starting. Without this switch the engine could not be started, as no oil pressure is present until the engine is running. This switch must be held depressed longer than the starter switch, or until the engine oil pressure swichgage reads above 138 kPa (20 PSIG).

SECTION 3 – SPECIFICATION

3.1 TABLE OF SPECIFICATION

BOOSTER:		**1809**	**1310**
Make & Model		ARC 1809 8V92T	ARC 1310 8V92T
Type		Reciprocating Piston	
Max. Inlet Press.		2413 kPa (350psig)	
Max. Delivery.		864 l/ sec (1800 acfm)	624 l/ sec 1300 (acfm)
Max. Discharge Press.		6207 kPa (900 psig)	6897 kPa (1000psig)
Compression Ratio	- Nominal.	2:1	
	- Maximum.	3:1	
No. of Stages		1	
No. of Cylinders		4	
Bore		60.3mm (2.375")	57.15 mm (2.250")
Stroke		127mm (5.0")	
Cooling System	- Pre.	Air to Air	
	- After.	Air to Air	
Lubricating System		See Engine	
Operating Tilt (Max.)		15 Degrees	

ENGINE:	
Make & Model	Detroit Diesel 8V92TA
Type	Two Stroke Diesel
Rated Speed	1800 rpm
Idle Speed	850 rpm
Power	210 HP
No. of Cylinders	4
No. of Cycles	2
Bore	123mm (4.84")
Stroke	127mm (5.0")
Displacement	368 cu. in.
Lubricating System	Full Pressure Oil
Cooling System	Self Contained
Oil Type	See Table 1
Coolant Capacity	Radiator Inhibitor/ Water Mix.
Oil Capacity	25 litres
Coolant Capacity	40 litres
Fuel Capacity	400 litres

ELECTRICAL:	
System Type	24 Volt Neg. Earth
Battery	DELCO N70ZZ
Alternator	Ingram 55 Amp
Fuel Solenoid	Woodward solenoid

FRAME:	
Length	1900 mm
Width	1500 mm
Height	2050 mm
Weight	2400 kg

SAFETY:	
HIGHER WATER TEMP SHUTDOWN.	> 99°C (210°F)
LOW OIL PRESS SHUTDOWN.	< 138 kPa (20 psig)
HIGH DISCHARGE AIR TEMP SHUTDOWN.	> 200°C (392°F)
INLET RELIEF VALVE SET PRESS.	2930 kPa (425 psig)
DISCHARGE RELIEF VALVE SET PRESS.	7239 kPa (1050 psig)

3.2 CAPACITY AND PRESSURE CHART

BOOSTER MODEL – 1809/1310 8V92T						
OPERATING CONDITIONS						
INDUCTION PRESSURE	kPa	1034	1379	1724	2068	2413
	Psig	150	200	250	300	350
DISCHARGE PRESSURE	kPa	2068	2758	3448	4173	4827
(2:1 ratio)	Psig	300	400	500	600	700
DISCHARGE PRESSURE	kPa	3103	4137	5172	6206	6897
MAXIMUM	Psig	450	600	750	900	1000
CAPACITY	1/sec	391	509	626	864	
(@ 2:1 ratio)	acfm	830	1080	1325	1800	
RPM MAX (loaded)		1800	1800	1800	1800	1800
RPM MIN (loaded)		1400	1400	1400	1400	1400
IMPORTANT HIGHER OR LOWER PRESSURES AND SPEEDS THAN						
THOSE SHOWN MUST NOT BE USED						
NOTE THIS CHART LISTS NOMINAL RATINGS ONLY. ACTUAL						
PRESSURES AND CAPACITY MAY VARY SLIGHTLY.						

3.3 BOLT TORQUE CHART

TORQUE SPECIFICATIONS				
WATER PLATE HEAD BOLTS	150	Nm	(110	Ft-Lb)
HEX. SPACER STUD	163	Nm	(120	Ft-Lb)
HEX. SPACER BOLTS				
COMPRESSOR HEAD BOLTS	136	Nm	(100	Ft-Lb)
INTAKE AND DISCHARGE manifold BOLTS	61	Nm	(45	Ft-Lb)
COMPRESSOR PISTON HEAD BOLTS	136	Nm	(100	Ft-Lb)
COMPRESSOR PISTON rod NUTS	61	Nm	(45	Ft-Lb)
COMPRESSOR PISTON rod BOLTS	54	Nm	(40	Ft-Lb)

3.4 LUBRICATION GUIDE

The reliability of the unit is dependent on the selection and maintenance of the lubricant. The ambient temperature, relative humidity and contamination levels must be considered in the lubricant selection. Should the unit be operated under severe conditions of heat, humidity or contaminant level, the change intervals recommended below must be reduced accordingly.

Table 1

VISCOSITY GRADE SELECTION		
Ambient Temperature		**Lubricant Recommendation**
°C	°F	PRIMARY
10 – 50	50 – 122	SAE 40 (Mobil 1240 or Castrol CRB40)
0 – 10	32 – 50	SAE 40 Plus Starting Aids
-18 – 0	0 – 32	SAE 40 Plus Starting Aids
Below -18	Below 0	SAE 40 Plus Starting Aids

Table 1 gives lubricant grade selections for different ambient temperatures.

APPLICATION GUIDE:

When ambient conditions exceed those noted or if conditions warrant use of extended life lubricants, contact Air Research Compressors for recommendation.

Air Research Compressors encourages the user to participate in an oil analysis program with the oil supplier. This could result in an oil change interval differing from that stated in the manual.

SECTION 4 – OPERATION

4.1 GENERAL

Optimum service can be expected from an Air Research booster when operating and service procedures are based upon a clear understanding of its working principles. While Air Research Compressors have built into this booster a comprehensive array of controls and indicators to assure you that it is running properly, you will want to recognize and interpret the readings which will call for service or indicate the beginning of a malfunction. Before starting your booster, read this section thoroughly, and familiarize yourself with the controls and indicators, their purpose, location, and use.

4.2 PURPOSE OF CONTROLS

OPERATORS CONTROL PANEL
Figure 2

OPERATORS CONTROL PANEL		
No	*Control or Indicator*	*Purpose*
1	IGNITION ON/ OFF SWITCH	Turn this switch to the "on" position to energize the electrical system of the machine. This switch is located on the instrument panel.
2	TATTLETALE OVERRIDE SWITCH	Located on the instrument panel, used to bypass the oil pressure switch when starting the engine. Hold until oil pressure is 137 kPa (15 – 20 psig).
3	ENGINE STARTER SWITCH	Depress to start the engine. This switch is located on the instrument panel. Release as soon as the engine fires.
4	ENGINE STOP SWITCH	Depress to stop the engine. This switch is located on the instrument panel. Release when the engine has stopped.
5	ALTERNATOR CHARGE INDICATOR	Indicates when alternator not charging.
6	BYPASS SWITCH	Activates remote control of manual Bypass Valve
7	HOURMETER	Indicates the accumulated hours of operation. Useful for planning and logging service schedules.
8	ENGINE WATER TEMERATURE SWICHGAGE	Monitors the temperature of the engine water and shuts engine down above 99°C (210°F). The normal operating temperature should read approximately 71 – 99°C (160 – 210°F).
9	VOLTMETER	Monitors the performance of the engine charging system and is the primarily indicator of an electrical malfunction. The normal reading is between 26.4 and 29 volts.
10	ENGINE OIL PRESSURE SWICHGAGE	Monitors the engine oil pressure and shuts engine down below 137 kPa (20 psig). The normal reading is 345 – 551 kPa (50 – 80 psig) @ 1800 rpm.
11	TACHOMETER	Indicates the engine speed.
12	INLET AIR PRESSURE GAUGE	Continually monitors the booster inlet air pressure at various load and unloaded conditions.
13	DISCHARGE AIR PRESSURE GAUGE	Continually monitors the booster discharge air GAUGE pressure at various load and unloaded conditions.
14	DISCHARGE AIR TEMPERATURE GAUGE	Monitors the air temperature in the booster discharge SWICHGAGE manifold and shuts engine down when above normal readings occur. The normal reading should be below 200°C (392°F).

OTHER CONTROLS		
No	*Control*	*Purpose*
17	INLET PRESSURE RELIEF VALVE	Opens inlet pressure to the atmosphere should the booster inlet air pressure exceed 3103 kPa (450 psig).
20	DISCHARGE PRESSURE RELIEF	Opens discharge pressure to the atmosphere should VALVE the booster discharge air pressure exceed 7421 kPa (1050 psig).
21	AUTO BYPASS VALVE	Automatically closes during boost mode and opens during bypass mode to prevent inlet pressures below 551 kPa (80 psig) and discharge pressures above 6207 kPa (900 psig).
24	INLET PRESSURE REGULATOR	Delivers a pressure signal regulated at 689 kPa (100 psig), to the auto bypass air actuator allowing the auto bypass valve to open and close according to signal conditions.

4.3 PREPARATION FOR USE

The following procedure should be used to prepare the booster for the initial start-up:

1. Examine the machine to ensure that it has not been externally damaged in shipment, and that all hoses, wiring, etc. are properly connected.

2. Position the machine on a level surface in a clean protected area so that proper amounts of liquid can be added.

   Note: The radiator is filled with a mixture of clean water and radiator inhibitor (see Specification section) at the factory before shipment.

3. Check the radiator coolant level. If needed, add a water and radiator inhibitor type solution (see Specifications section) to the engine radiator. During filling, make certain that entrapped air escapes from the system.

4. Check crankcase lubrication oil level. If needed, add oil, (see Specification section) to near the dipstick "full" mark, but do not overfill.

5. Fill fuel tank with clean diesel fuel.

6. Re-connect the negative (- NEG) electrical cable to the negative (- NEG) battery terminal. Check the battery electrolyte level. If needed, add distilled water to the bottom of the level indicators.

7. No break-in period is required, as the booster assembly has been fully tested and run-in at the factory.

4.4 START-UP PROCEDURE

The following procedure should be used to start the booster and prepare it for operation:

PRIOR TO STARTING:

1. Check fuel, oil and coolant levels.
2. Check for fuel, oil and coolant leaks.
3. Check air cleaner clamps and hoses.
4. Check battery clamps.
5. Check and adjust tension on fan belts.
6. Check and tighten any loose fittings.

STARTING:

1. Close valves in the inlet and discharge lines to and from the booster compressor.
2. Connect the inlet and discharge hoses to and from the booster, taking care not to allow any dirt or particles to enter the hoses. See section 1.3, part G for recommended hose size.
3. Remove all pressure from booster compressor.
4. Turn the on-off switch to the "on" position.
5. Simultaneously push the starter and override buttons.

   CAUTION: ENGINE SHOULD NEVER BE STARTED WITH PRESSURE ON THE BOOSTER.

6. Release the starter button as soon as the engine fires and release the override button when oil pressure reaches 137 kPa (20 psig).

   NOTE: IF NOT OIL PRESSURE IS INDICATED WITHIN 10 TO 15 SECONDS, STOP THE ENGINE AND CHECK THE LUBRICATING OIL SYSTEM.

7. While engine is idling, check for fuel, oil and coolant leaks, correct idle speed, and voltmeter for charging.
8. When the engine water temperature reaches 71°C (160°F) the machine is ready for use.

4.5 OPERATING PROCEDURE

The following procedure should be used for operating the booster:

COMMENCING OPERATION:

1. Bring air pressure from compressor supplying booster to closed inlet valve.

2. Open main control valve on machine using boosted air.

3. Open discharge line valve.

4. Open inlet line valve.

5. Check inlet and discharge pressure. Discharge pressure will vary according to resistance downstream from booster. Do not exceed 3:1 Compression Ratio.

DURING OPERATION:

1. When a break in operation is required, close main control valve on machine using boosted air.

   Note: The auto bypass system is designed to automatically hold the booster in bypass mode while pressure is held in the discharge line. If it is preferred not to hold high pressure in the discharge line during a break in operation, then before step 1 turn auto bypass switch to the bypass or manual/remote position, and after step 2 turn auto bypass switch to the boost or auto position.

2. When resuming operation, open main control valve on machine using boosted air.

3. Repeat steps 6 and 7 COMMENCING OPERATION.

4.7 SHUTDOWN PROCEDURE

ROUTINE:

1. Turn the auto bypass switch to the bypass position. If a remote line is used, then this should be turned off.

2. Close inlet valve.

3. Remove pressure from booster by opening one of the drain valves.

4. Close discharge valve.

5. Allow booster to idle for a 5 minutes to cool down and allow moisture to exit the system.

6. Turn the on-off switch to the "off" position.

EMERGENCY:

1. Turn the on-off switch to the "off" position.

2. Repeat steps 1 to 4 ROUTINE SHUTDOWN.

PRELONGED SHUTDOWN:

1. Shut off compressors feeding the booster compressor.

2. Turn the auto bypass switch to the bypass position. If a remote line is used, then this should be turned off.

3. Close inlet valve.

4. Remove pressure from booster by opening one of the drain valves.

5. Close discharge valve.

6. Allow booster to idle for a 5 minutes to cool down and allow moisture to exit the system.

7. Remove both inlet and discharge hoses.

8. Open both inlet valve and discharge valve.

9. Spray into the inlet valve a moisture/rust inhibitor until evidence can been seen of the inhibitor exiting the discharge valve.

10. Close inlet valve.

11. Close discharge valve.

12. Turn the on-off switch to the "off" position.

SECTION 5 – MAINTENANCE

5.1 GENERAL

A good maintenance program is the key to long machine life. Below is a program that when adhered to should keep your machine in top running condition. Also included in this program are routine service operations required for the engine. However, these are as stated, routine. For maintenance requirements other than stated below, refer to the Engine Operators Manual where a more detailed description of service instructions is given. See Section 5.8 Parts Replacement and Adjustment Procedures for detailed maintenance instruction of specific booster system components.

5.2 DAILY OPERATION

Prior to starting the booster check, and adjust where necessary, the engine oil level, radiator coolant level, fuel level, fan belt tension, air cleaner for blockage, leaks, or deterioration, drain the scrubber tank and auto bypass filters, and check drain plug on the bottom of the inlet strainer.

NOTE

The engine cooling system must be drained and flushed every two years. Replace the coolant with a solution of glycol type coolant and water. Do not use a leak sealing type of anti-freeze. Should a 100% water solution be used, a rust inhibitor must be added.

After a routine start has been made, observe the instrument panel gauges and be sure they monitor the correct readings for that particular phase of operation. After the machine has warmed up, it is recommended that a general check on the overall machine and instrument panel be made to assure that the booster is running properly. Also check the air filter maintenance indicator. Should the indicator show red, wash or replace the element immediately. (See Air Filter Maintenance in Section 5.8). Always be sure that you reset the air filter restriction gauge after maintenance.

5.3 MAINTENANCE EVERY 50 HOURS OR WEEKLY

After every week or 50 hours of operation, it will be necessary to perform the following:

1. Perform daily checks.

2. Check air cleaner element and dust cup assembly.

3. Check and repair any leaks or other damages.

5.4 MAINTENANCE EVERY 100 HOURS OR MONTHLY

After every month or 100 hours of operation, perform the following:

1. Perform 50 hour/ weekly checks.

2. Check the battery level and fill with water if necessary.

3. Change or clean air filter element.

5.5 MAINTENANCE EVERY 250 HOURS OR 3 MONTHS

After every 3 months or 250 hours of operation, perform the following:

1. Perform 100 hour/ monthly checks.

2. Change the engine oil and oil filter. This is best done when the engine is hot.

3. Change the fuel filter. Should persistent clogging be evident, change the fuel filter more frequently.

4. Check fan belt tension.

5. Clean the radiator exterior. Depending on how contaminated the atmosphere may be, more frequent radiator cleaning may be necessary.

5.6 MAINTENANCE EVERY 500 HOURS OR 6 MONTHS

After every 6 months or 500 hours of operation, perform following:

1. Perform 250 hour/ 3 month checks.

2. Examine all hoses and replace as needed.

3. Check operation of safety shutdown swichgages.

5.7 MAINTENANCE EVERY 1000 HOURS OR ANNUALLY

After every year or 1000 hours of operation, perform the following:

1. Perform 500 hour/ 6 month checks.

5.8 PARTS REPLACEMENT AND ADJUSTMEN PROCEDURE

AIR FILTER MAINTENANCE

Air filter maintenance should be performed when the air filter restriction indicator shows red. The restriction indicator is located at the front of the air filter housing. The air filter is equipped with a main element and pre cleaner cap. The restriction indicator will alert you as to when the main element maintenance is necessary.

ELEMENT REMOVAL

1. Clean the exterior of the air filter housing.
2. Loosen the locking ring at the rear of the housing and remove the dust cover from the housing.
3. Remove the element assembly by loosening the wing-nut securing it.
4. Pull the element assembly out of the housing.
5. Clean the interior of the housing by using a damp cloth. Do not blow out dirt with compressed air.
6. Clean or replace the primary element. Cleaning instructions follow.

AIR FILTER ELEMENT CLEANING

The air filter primary element is cleanable by one of two methods. One method is by washing with clean water and a mild household detergent if the element is contaminated with grease or oily

dirt. The other method is cleaning with compressed air. The maximum amount of times that an element should be cleaned is six (6) times however, the element should be used no longer than a period of one (1) year without changing.

Prior to cleaning an element, check the element for damage. Damaged elements are to be replaced. When cleaning an element, never exceed the recommended maximum pressures for water 275 kPa (40 psig) or compressed air 200 kPa (30 psig).

Do not strike the element against any hard surface to dislodge dust. This will damage the sealing surfaces and possibly rupture the element. Never "blow" dirt out of the interior of the filter housing. This may introduce dust downstream of the filter. Instead, use a clean damp cloth. Do not oil the element.

Method 1: Cleaning the Element by Washing
When washing the element, never use petroleum solutions or solvents. Also, never immerse a dirty element in water or cleaning solution. This will carry dust onto the "clean side" (inside surface) of the element. Instead, dust must be removed by reverse flushing the element. Use clean clear water with a garden hose at no more than 275 kPa (40 psig). Direct the water up and down the pleats in the filter media from the "clean side" of the element until all dust is removed. If, after washing as described above, the element is found to be contaminated with oil or greasy dirt, it should then be agitated in a solution of mild household detergent and water. Add 10 gms (4 tablespoons) of detergent to 4 litres (one gallon) of lukewarm water and mix well. After a sufficient amount of agitation has been done, rinse thoroughly and carefully shake out excess water. Lay the element on its side and allow to dry before installation. The element should be protected from dirt and/ or freezing while drying. Mechanical drying methods can be used; however, heated air must be well circulated and must not be over 71°C (160°F). Do not use a light bulb for drying. Also, compressed air must not be used for drying, as the pressure will rupture the element when wet. Regardless of the drying procedure, always inspect the element for damage prior to installation. (See element inspection).

Method 2: Cleaning the Element with Compressed Air
When cleaning the element with compressed air, never let the air pressure exceed 200 kPa (30 psig). Reverse flush the element by directing the compressed air up and down the pleats in the filter media from the "clean side" of the element. Continue reverse flushing until all dust is removed. Should any oil or greasy dirt remain on the filter surface, the element should then be cleaned by Method Number 1. When the element is satisfactorily cleaned, inspect thoroughly prior to installation, (See element inspection).

Element Inspection

1. Place a bright light inside the element to inspect for damage or leak hole. Concentrated light will shine through the element and disclose any holes.

2. Inspect all gaskets and gasket contact surfaces of the housing. Should faulty gaskets be evident, correct the condition immediately.

3. If the clean element is to be stored for later use, it must be stored in a clean container.

4. After the element has been installed, inspect and tighten, if necessary, all air inlet connections prior to resuming operation

PRESSURE REGULATOR MAINTENANCE
Refer to pressure regulator data sheets for repair and maintenance instructions.

AIR RESEARCH BOOSTER MAINTENANCE LOG

MODEL NO._____ SERIAL NO._____

OWNER_____

DATE	SERVICE HOURS	SERVICE PERFORMED	BY INITIALS

AIR RESEARCH BOOSTER REPAIR LOG

MODEL NO._____SERIAL NO._____

OWNER_____

DATE	ACCUM HOURS	REPAIRS PERFORMED	BY INITIALS

BOOSTER VALVE CHECK

1. Remove induction piping from booster heads.

2. Pressurize discharge manifold to 551 – 689 kPa (80 – 100 psig)

3. By looking into intake part of booster heads, the intake portion of the valve can be seen. Using a screwdriver with a 6" to 8" blade, push the intake plate away from its seat (down) to unload valve. It may take a slight bump with the heel of your hand to do so.

4. A continuing rush of air from the unloaded valve indicates discharge plate damage and the valve should be replaced. A continuing airflow from booster valve with the intake not held open indicates a leaking intake o-ring and the o-ring should be replaced.

5. A damaged or broken discharge plate in the booster valve will let compressed air leak back into the cylinder and, on the down stroke of the piston, allows compressed air to go past piston rings and enter into crankcase causing excessive crankcase pressure and premature ring wear.

   Note: An early sign of leaking discharge valve is higher than normal induction pressure on booster gauge.

6. At first sign of excessive crankcase pressure, the booster valves should be checked i.e. oil blowing out dipstick or fill cap, or excessive engine oil consumption.

7. If booster valves check O.K., unit should be run at 1800 rpm with rig air supply disconnected and discharge airline disconnected with intake and discharge valve open (no air being compressed). If excessive crankcase pressure still exists, the problem is on the power side of the engine.

8. If, upon completion of step 7, excessive crankcase pressure does not exist, booster cylinders should be removed and pistons, rings, and cylinders should be checked for damage or excessive wear.

5.9 TROUBLE SHOOTING

SYMPTOM	PROBABLE CAUSE AND REMEDY
ENGINE WILL NOT START	1. No fuel. a. Check fuel level and add fuel if necessary 2. Blocked fuel filter. a. Replace the element 3. Low battery voltage. a. Check electrolyte level and add distilled water, and recharge if necessary 4. Blocked air filter. a. Clean or replace the element 5. Engine problems may have developed. a. Refer to your Engine Manual 6. Faulty oil pressure swichgage, water temperature swichgage, discharge temperature swichgage or inlet temperature swichgage. a. Check swichgages accuracy and continuity and replace if necessary 7. Blown fuse. a. Check continuity and replace if necessary 8. Faulty fuel rack solenoid. a. Check operation and replace if necessary 9. Water in fuel. a. Drain water from tank and lines, and add fuel if necessary 10. Faulty wiring loom. a. Check continuity and repair if necessary 11. Faulty start switch. a. Check continuity and replace if necessary 12. Faulty starter motor. a. Check operation and repair or replace if necessary 13. Restricted fuel line. a. Remove restriction or replace fuel line if necessary 14. Air leaks in fuel line. a. Seal leaks or replace fuel line if necessary
ENGINE SHUTS DOWN	1. No fuel. a. Check fuel level and add fuel if necessary 2. Discharge temperature swichgage activating. a. Compression ratio to high: check 3.2 capacity and pressure chart for capacity requirements to maintain required pressures and adjust if necessary b. Cooling airflow is insufficient: check coolers for proper ventilation and clean if necessary; check fan belt tension and adjust if necessary c. Faulty discharge temperature swichgage: check swichgage accuracy and continuity and replace if necessary 3. Oil pressure swichgage activating. a. Low oil level: check oil level and add oil if necessary b. Faulty oil pressure swichgage: check swichgage accuracy and continuity and replace if necessary 4. Water temperature swichgage activating. a. Cooling airflow is insufficient: check radiator for proper ventilation and clean if necessary; check fan belt tension and adjust if necessary b. Low water level: check water level and add water if necessary c. Faulty water temperature swichgage: check swichgage accuracy and continuity and replace if necessary

SYMPTOM	PROBABLE CAUSE AND REMEDY
	5. Blown fuse. a. Check continuity and replace if necessary 6. Faulty fuel rack solenoid. a. Check operation and replace if necessary 7. Water in fuel. a. Drain water from tank and lines, and add fuel if necessary 8. Faulty wiring loom. a. Check continuity and repair if necessary 9. Blocked fuel filter. a. Replace the element 10. Blocked air filter. a. Clean or replace the element 11. Engine problems may have developed. a. Refer to your Engine Manual 12. Restricted fuel line. a. Remove restriction or replace fuel line if necessary 13. Air leaks in fuel line. a. Seal leaks or replace fuel line if necessary
UNABLE TO OBTAIN HIGH DISCHARGE PRESSURES	1. Air demand too great. a. Check service lines for leaks or open valves b. Drill string or hole conditions: check 3.2 capacity and pressure chart for capacity requirements to maintain required pressures and adjust if necessary 2. Faulty bypass valve. a. Check valve and repair or replace if necessary 3. Faulty concentric valve or valves. a. Perform booster valve check and replace valve or valves if necessary
DISCHARGE SAFETY VALVE "POPS OFF"	1. Pilot valve is set too high. a. Check setting and adjust if necessary 2. Leaks or restriction in the control system causing pilot signal pressure loss. a. Check control lines and components 3. Bypass valve jammed. a. Free valve or replace if necessary 4. Bypass valve air actuator jammed. a. Free air actuator or replace if necessary 5. Water in control system causing slow bypass reaction time. a. Check all control lines and components 6. Faulty discharge safety valve. a. Replace discharge safety valve 7. Internal restriction in Aftercooler. a. Check Aftercooler and clear restriction 8. Blocked or faulty discharge check valve. a. Check discharge check valve and unblock, or repair or replace if necessary 9. Faulty pilot valve. a. Check pilot valve and repair or replace if necessary 10. Blocked bypass filter elements. a. Check filter elements and clean or replace if necessary 11. Faulty bypass pilot regulator. a. Check pilot regulator and repair or replace if necessary

SYMPTOM	PROBABLE CAUSE AND REMEDY
INLET SAFETY VALVE "POPS OFF"	1. Supply pressure too high. a. Check 3.2 capacity and pressure chart for capacity requirements to maintain required pressures and adjust if necessary 2. Bypass vent valve blocked or faulty. a. Check vent valve and unblock, or repair or replace if necessary
EXCESSIVE OIL CONSUMPTION	1. Engine problems may have developed. a. Refer to your Engine Manual 2. Faulty concentric valve or valves. a. Perform booster valve check and replace valve or valves if necessary 3. Oil level too high. a. Check oil level and remove excess oil if necessary 4. Blocked air filter. a. Clean or replace the element 5. Excessive ring and piston clearances. a. Performing booster valve check will indicate whether further inspection is required and, if necessary, replacement of rings, pistons and cylinders is warranted
BOOSTER OVERHEATING	1. Loose or broken fan belt. a. Tighten or change fan belt 2. Dirty Precooler core. a. Clean Precooler core thoroughly 3. Faulty discharge temperature swichgage. a. Check swichgage accuracy and replace if necessary 4. Internal restriction in Precooler. a. Check Precooler and clear restriction
ENGINE OVERHEATING	1. Loose or broken fan belt. a. Tighten or change fan belt 2. Dirty radiator core. a. Clean radiator core thoroughly 3. Low water level. a. Check water level and water if necessary 4. Faulty engine thermostat. a. Check thermostat operation and replace if necessary 5. Internal restriction in radiator. a. Check radiator and clear restriction 6. Low oil level. a. Check oil level and add oil if necessary 7. Faulty water pump. a. Check water pump and repair or replace if necessary 8. Other engine problems may have developed. a. Refer to your Engine Manual