AUSTART
AIR STARTERS

INSTALLATION AND MAINTENANCE MANUAL

AUSTART AS69U VANE STARTER

KH Equipment
Precision Engineering

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NOTICE

THIS MANUAL CONTAINS IMPORTANT SAFETY INFORMATION. IT IS IMPORTANT THAT THE ENTIRE CONTENTS BE STUDIED BEFORE INSTALLATION AND OPERATION. IT ONLY REFLECTS GENERIC INFORMATION RELATING TO A STANDARD AUSTART AS69U AIR STARTER.

FOREWORD

This manual contains instructions for the installation, maintenance and operation of your new AS69U AUSTART Air Starter motor. It has been designed to provide you with safe and reliable service. However, it is both a pressure vessel and a piece of rotating machinery. Therefore operators and maintenance personnel must exercise good judgement and appropriate safety practices to avoid damage to the equipment and prevent personal injury. The instructions in this manual are intended for personnel with a general training in the operation and maintenance of air starter equipment. It should be understood that the information contained in this manual does not relieve the operating and maintenance personnel of the responsibility for exercising good normal judgement in the operation and care of air starter equipment and their associated systems.

Throughout this manual you will encounter the words: 'WARNING', 'CAUTION' and 'NOTICE'. These paragraphs are intended to emphasise certain areas where personnel safety and satisfactory starter operation may be compromised should the message be ignored. The definitions of these words are as follows:-

⚠ WARNING

An operating procedure, practice, etc. that if not strictly observed could result in personal injury.

CAUTION

An operating procedure, condition, etc. that if not followed, could result in damage to, or the destruction of equipment.

NOTICE

An operating procedure, condition, etc. that is essential to highlight and observe.

It is advisable that a safety program be established to address the safety issues detailed within this manual before installing, operating or maintaining this equipment. It is important such a program covers the hazards associated with compressed air.

⚠ WARNING

Do not install this starter other than in accordance with the instructions detailed in this manual.

These instructions should be read completely before beginning installation and should be available to personnel responsible for operating and maintaining this equipment. The unit is capable of trouble free operation when properly applied, installed and maintained.

Extra copies of this manual are available from your local AUSTART Air Starter distributor or the factory.

This manual is designed to cover all situations normally experienced when installing, operating and maintaining this equipment. In the event situations are encountered that are not covered by this manual, consult your AUSTART agent or K.H. Equipment Pty Ltd direct.

AUSTART PRODUCT NUMBERING

STARTER MODEL	FLANGE CODE	PINION CODE	SPECIAL FEATURES

MODEL PREFIX CODES:

AS	AUSTART VANE STARTER
ATS	AUSTART TURBINE STARTER

AS50	Austart Air Starter
ATS53	Austart Turbine Starter
ATS54	(ATS53 OH) Austart Turbine Starter
AS55	(AS50 OH) Austart Air Starter
AS61	Austart Air Starter
ATS63	Austart Turbine Starter
ATS64	(ATS63 OH) Austart Turbine Starter
AS66	Austart Air Starter
AS67	Austart Air Starter
AS68	(AS6070) Austart Air Starter
AS69	(AS67OH) Austart Air Starter
AS70	Austart Air Starter
ATS71	Austart Turbine Starter
ATS73	Austart Turbine Starter
ATS77	Austart Turbine Starter
AS75	(AS70 OH) Austart Air Starter
AS78	(AS7080) Austart Air Starter
AS80	Austart Air Starter
ATS83	Austart Turbine Starter
ATS84	(ATS83 OH) Austart Turbine Starter
AS85	(AS80 OH) Austart Air Starter
AS90	Austart Air Starter
ATS93	Austart Turbine Starter
ATS94	(ATS93 OH) Austart Turbine Starter
AS95	(AS90 OH) Austart Air Starter
AS100	Austart Air Starter
ATS103	Austart Turbine Starter
ATS183	Austart Turbine Starter

01	SAE 1
02	SAE 2
03	SAE 3
04	SAE 4
	Other options available

09	9TH 3MOD R
10	10TH 8/10 R
11	11TH 6/8 R
12	12TH 8/10 R
13	12TH 8/10 L
14	11TH 6/8 L
15	10TH 8/10 L
16	9TH 3MOD L
	Other options available

B	BCB (Beryllium Copper Bronze Pinion)
E	Threaded Exhaust 1.5"
F	Threaded Exhaust 2" Bolt On
G	Threaded Exhaust 2"
H	Highway Special
I	Inertia Drive
J	Threaded Exhaust Elbow 2"
K	Kelly Spinner Muffler
M	Mining Spec.(Cast Iron)
N	Short Nose (Inertia ATS77)
P	Motor Ports 90°
R	Reduced Muffler
S	Short Muffler
T	Threaded Exhaust 3"
U	U Configuration
V	Value Muffler (ATS77)
X	Special – Refer Factory

EXAMPLES OF BASIC STARTER PRODUCT NUMBERING

ATS63-0110M	PERKINS 1006	SAE1	10TH	MINING SPEC
ATS63-0409M	MWM D916-6	SAE4	9TH	MINING SPEC
ATS73-0311	CUMMINS N14	SAE3	11TH	
ATS73-0314	CUMMINS N14	SAE3	11TH	LH
ATS73-0311I	DETROIT 12V71	SAE3	11TH	INERTIA DRIVE
ATS73-0314I	DETROIT 12V71	SAE3	11TH	INERTIA DRIVE LH
ATS73-0312M	CATERPILLAR 3306	SAE3	12TH	MINING SPEC
ATS83-0311IT	WAUKESHA 7072	SAE3	11TH	INERTIA THREADED EXHAUST

INSTALLATION AND PREPARATION FOR OPERATION

⚠ WARNING

- Maximum pressure for AUSTART starting equipment is 150psi (standard operating pressure is 100psi).
- Ensure air supply is isolated before installation, removal, maintenance or adjustment of your AUSTART starter.
- Before any starter is taken out of service first bleed the air receiver of air and any moisture that may have accumulated by opening up the drain valve. Do not bleed by removing the receiver plugs.
- Remove air hoses to ensure complete safety once the air supply has been isolated and the receiver has been bled.
- The air receiver must be manufactured to an applicable pressure vessel code such as AS1210 or similar.
- Only use air hoses and fittings that are of adequate size as indicated in the installation schematic (page 6).
- Always carry out a pressure test on the complete starting system before beginning operation. Do not begin operations until satisfied the unit has been installed correctly.
- Do not initiate a start until all components have stopped rotating, this includes the engine and starter motor.
- Always use recommended lubricants where prescribed by this manual. Under no circumstances use flammable or volatile liquids.
- Ensure all fasteners are torqued to the values prescribed in this manual. Use thread sealant where indicated.
- To ensure warranty provisions are not invalidated use only genuine AUSTART replacement parts. Non-genuine parts may cause service and performance problems and may affect the safe operation of your starter.

PRELIMINARY INSTALLATION REQUIREMENTS

Numbers in brackets refer to items numbers on Exploded View drawing on page 8.

1. Your AUSTART Starter is flange mounted. Before installing the starter carefully study the mating position of the starter and engine flanges to determine whether the air inlet port orientation or nose housing (34) geometry will suit your particular installation. If not re-orientate as follows - Rotate motor housing by 60 degree increments or by rotating the nose housing (34) by 30 degree increments. Also the front flange housing (36) can be orientated in 15 degree increments, which is the preferred method.

NOSE ASSEMBLY

- Start by separating the nose sub assembly from the gear cover and support starter motor with the nose assembly facing down on a work bench.
- Remove screws (17) and (18) and remove cover plate (15) by lightly tapping sideways with a soft hammer to break the sealing gasket.
- Remove spacer (46) and idler gear (45).
- Remove screws (23). The nose assembly will now spring apart. Pay particular attention not to allow nose to spring too far, as damage to seal (38) from pinion (39) can occur.
- Orientation of the nose assembly can now be achieved by rotating the nose housing in 30 degree increments.
- Once obtained gently push down on the gear cover assembly (25) feeding the piston (28) and wiper seal (29) into rear housing (34) being careful not to damage o'ring (33).
- Replace screws (23) and re-tighten.

MOTOR ASSEMBLY

- Remove screws (16). Orientation can now be achieved.
- Re-assemble screws (16) replace idler gear (45) and spacer (46) onto idler shaft (43).
- Apply liquid gasket such as Loctite 515 or similar to mounting face of gear cover (25). Replace cover plate (15) and retighten with screws (17) and (18).

2. Ensure pinion is suitable for engine application i.e. correct pitch, diameter and number of teeth.

3. Check flange to ring gear (FRG) spacing is correct and that flange spacers are not required. Pinion should be FRG less 1/8" (3mm) when at rest.

4. Check AUSTART starter clears all obstacles and the flange mounts to flywheel housing squarely without using undue force.

5. Ensure the hoses, fittings and starter ports are clean and free from dirt and foreign objects. Ensure they remain so during installation.

6. For optimum AUSTART starter performance ensure air supply pipes or hoses have an internal diameter of at least ¾" (19mm) refer Installation Schematic on page 6. In the event line, length must be longer than 15ft (5m), a size of 1" (25mm) should be used. Keep the number of fittings and the length of piping to a minimum. Avoid the use of reducing bushes and other fittings that could impede air flow.

INSTALLING THE STARTER AND PIPEWORK

Refer to the Starter Installation Schematic drawing on page 6.

1. The air supply line should ideally exit from the top or side of the air receiver.

CAUTION

Do not connect air supply line to the bottom of the air receiver. Moisture and system contaminants collect at the receiver bottom and can damage the AUSTART starter internals if allowed to pass through. Periodically drain moisture from the air receiver using a drain valve connected at the receiver bottom.

2. Install a LS1000M lube relay valve. The AUSTART AS69U series air starter should be lubricated with light weight oil or diesel fuel.

3. Mount the SC25 starter control button onto the vehicle dash board or appropriate control panel and connect to the air receiver using a minimum of ¼" (6mm) line.

NOTICE

Ensure the inlet side of the starter control button connects to the line from the receiver. Any safety 'switches' should be installed in this line between the starter control button and the air receiver.

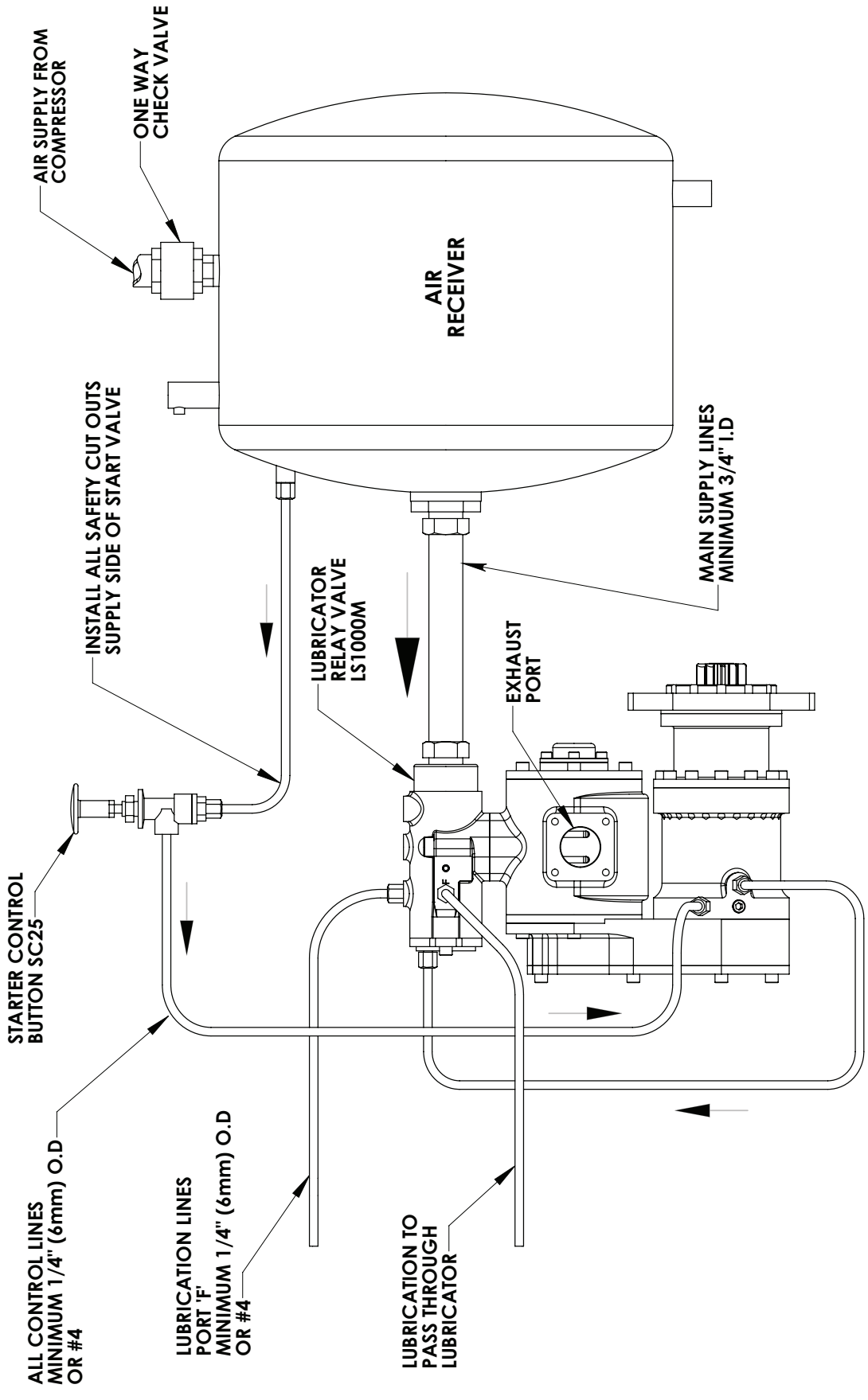
4. Determine the practicality of running the main air supply hose or pipe from the exit of the relay valve to the inlet of the AUSTART starter after the starter is mounted in to position.

5. Once the AUSTART starter is mounted, fit the remaining ¼" (6mm) control lines from the AUSTART starter to the starter control button and relay valve respectively (refer page 6).

6. Make all hose or pipe connections leak proof using a suitable thread sealant.

7. Once the connections have been made, pressurise the system and check for leaks using soapy water or similar solution.

INSTALLATION SCHEMATIC



INPUT LUBRICATION TO LOWEST PORT ON LUBRICATOR RELAY VALVE (LRV)
AND RETURN TO TANK VIA HIGHEST PORT.
(TO MAINTAIN OIL IN VALVE AND REDUCE DRAIN BACK.)

- IT IS ADVISABLE TO INTRODUCE A SQUIRT OF OIL TO INLET SIDE OF STARTER PRIOR TO FIRST OPERATION.

TITLE

AS69 - Schematic

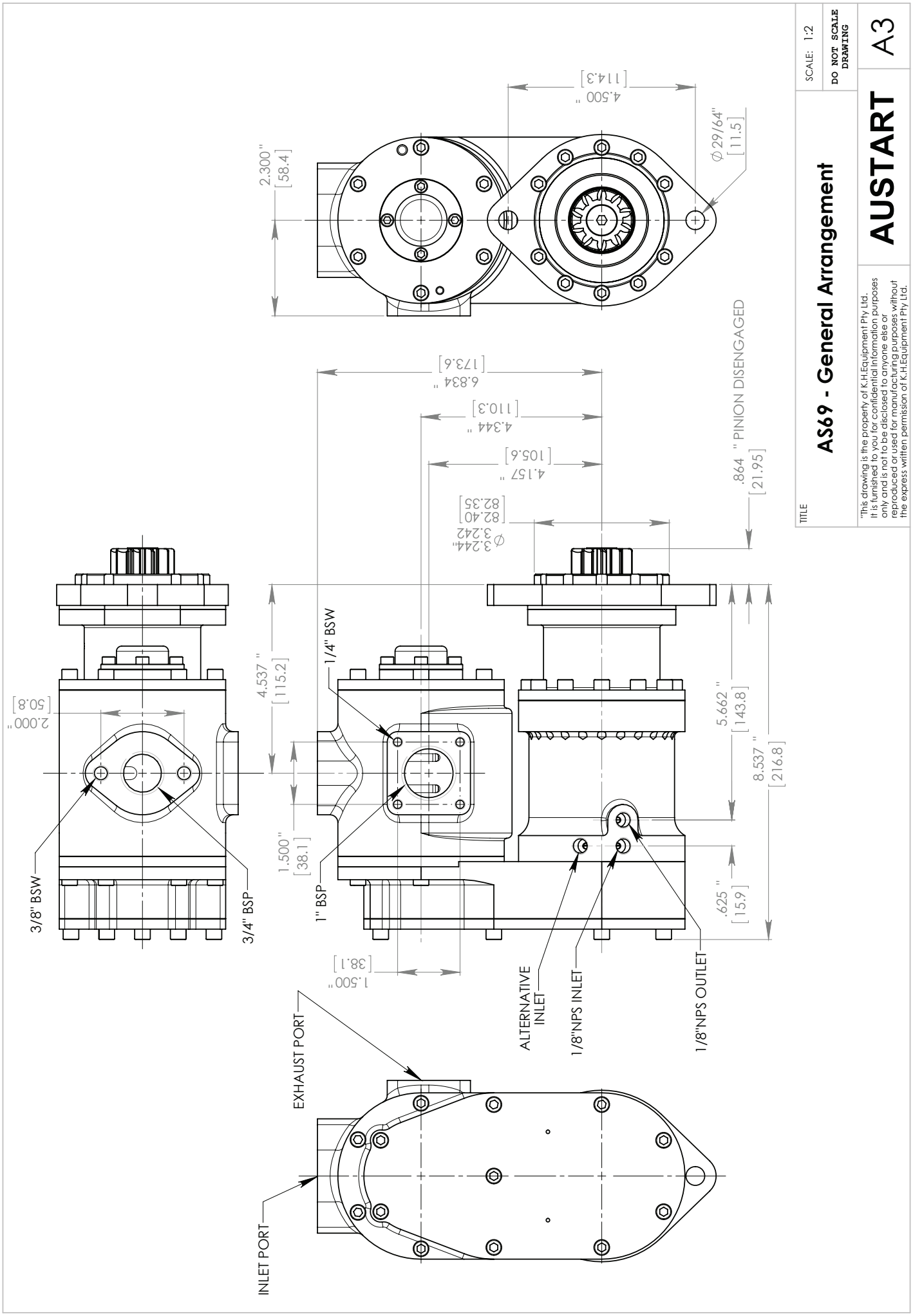
SCALE: 1:3

DO NOT SCALE DRAWING

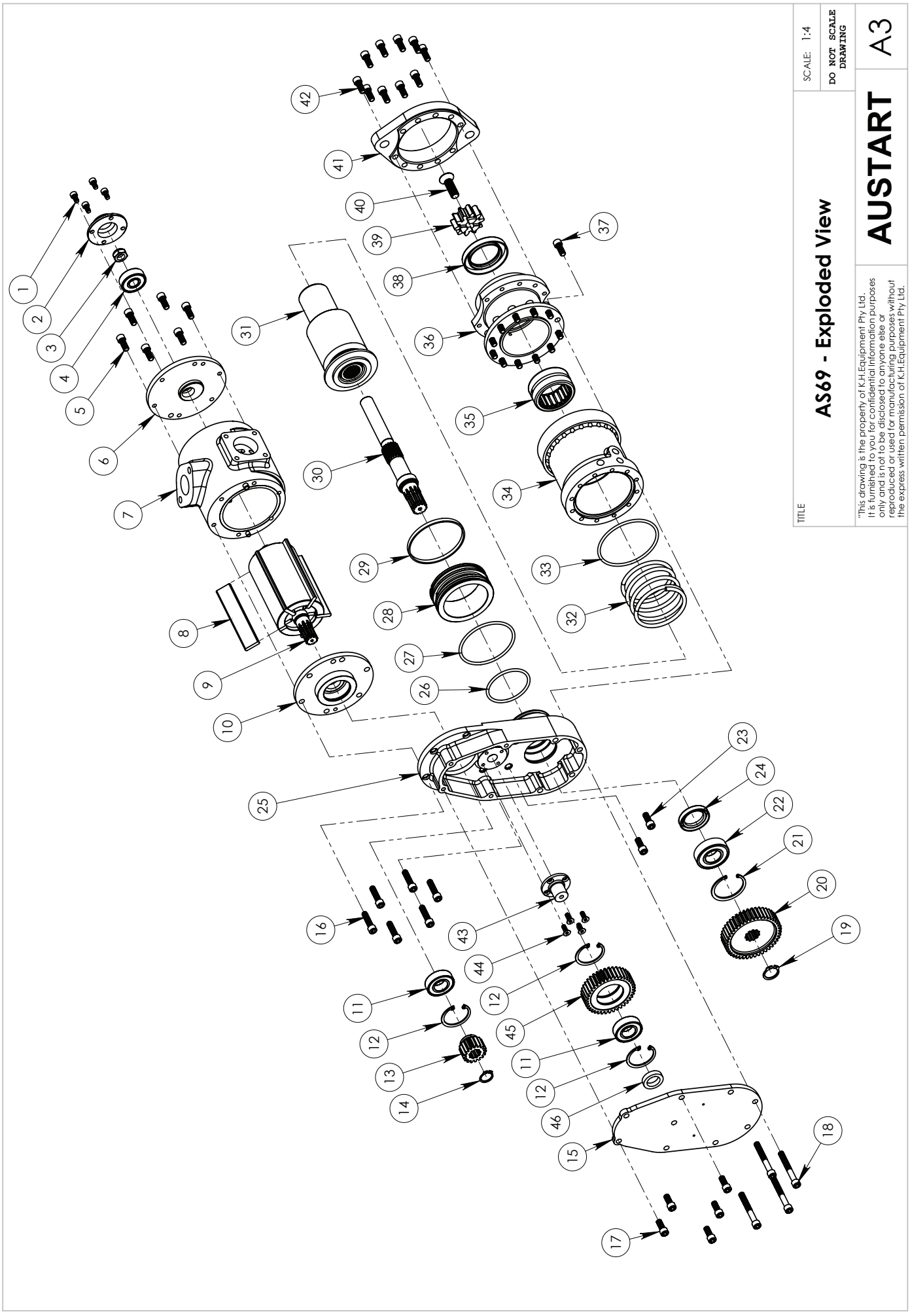
AUSTART A3

"This drawing is the property of K.H.Equipment Pty Ltd. It is furnished to you for confidential information purposes only and is not to be disclosed to anyone else or reproduced or used for manufacturing purposes without the express written permission of K.H.Equipment Pty Ltd.

GENERAL ARRANGEMENT



EXPLODED VIEW



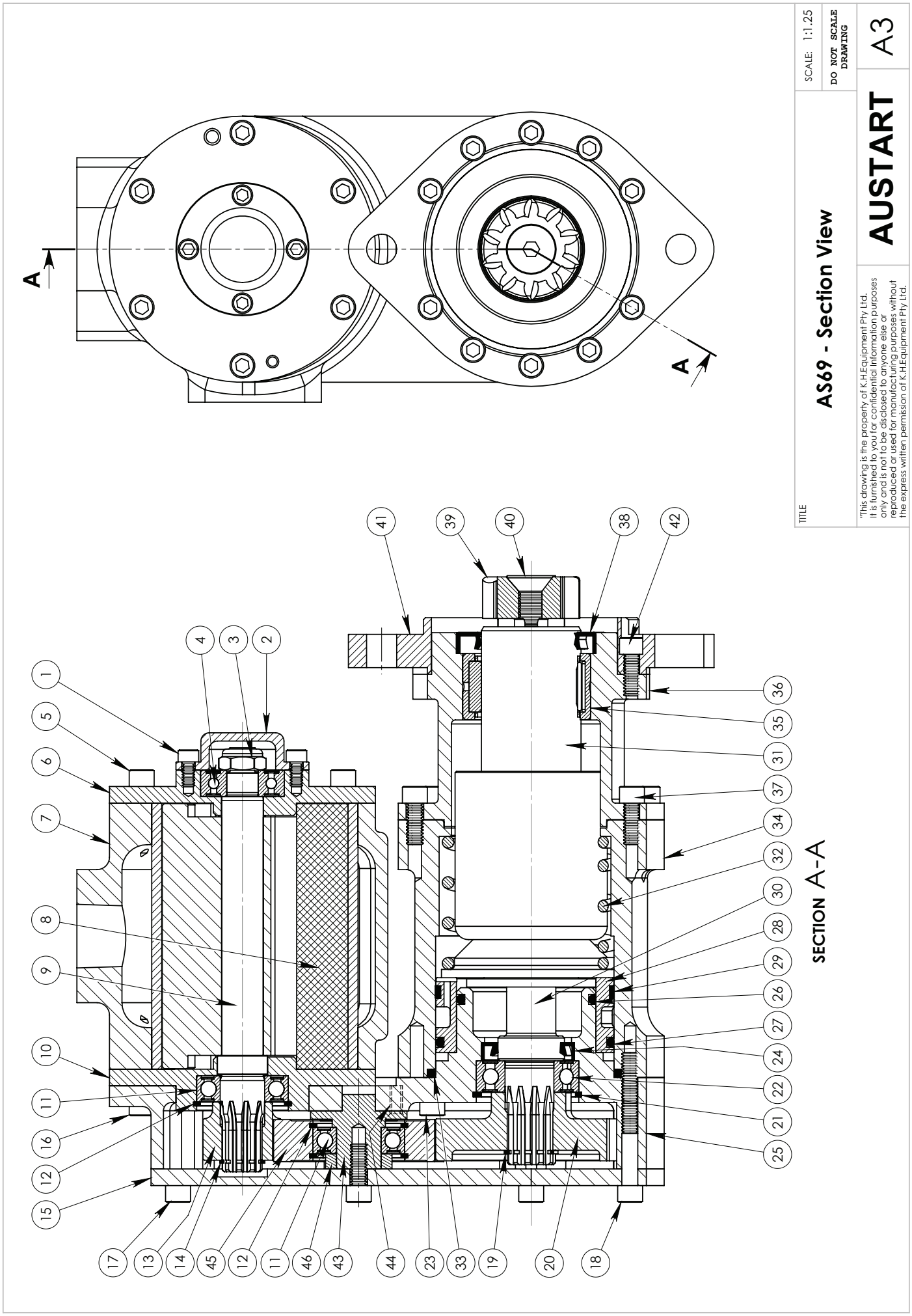
AUSTART AS69U

General Build List

ITEM	PART NO.	EXT.	DESCRIPTION		QTY	ITEM	PART NO.	EXT.	DESCRIPTION		QTY
1	6001	000	Screw		4	25	6761	300	Gear Cover		1
2	6002	100	Cap		1	26	6730	000	O' Ring	+	1
3	6003	000	Nut		1	27	6732	000	O' Ring	+	1
4	6004	000	Bearing	+	1	28	6726	100	Piston		1
5	6005	000	Screw		6	29	6733	500	Seal	+	1
6	6006	100	End Cover		1	30	6750	100	Shaft		1
7	6007	xxx	Motor Housing		1	31	6760	900	Drive Assembly		1
8	6008	500	Blade	+	5	32	6734	000	Spring		1
9	6609	900	Rotor Shaft Assembly		1	33	6731	000	O' Ring	+	1
10	6610	100	End Cover		1	34	6762	200	Rear Housing		1
11	6611	000	Bearing	+	2	35	7054	000	Bearing	+	1
12	6612	000	Circlip	+	3	36	6763	xxx	Front Housing		1
13	6613	100	Gear		1	37	6005	000	Screw		12
14	6614	000	Circlip	+	1	38	7056	000	Seal	+	1
15	6772	300	Cover Plate		1	39	6765	xxx	Pinion		1
16	6018	000	Screw		6	40	6758	000	Screw		1
17	6005	000	Screw		5	41	6729	xxx	Flange		1
18	6627	000	Screw		4	42	6005	000	Screw		10
19	6617	000	Circlip	+	1	43	6767	100	Idler Pin		1
20	6718	100	Gear		1	44	6115	000	Screw		4
21	6619	000	Circlip	+	1	45	6768	100	Gear		1
22	6012	000	Bearing	+	1	46	6771	100	Spacer		1
23	6005	000	Screw		2						
24	6621	000	Seal	+	1						
							6740	920	SERVICE KIT Items Marked +		

XXX DENOTES OPTIONS AVAILABLE

SECTION VIEW



MAINTENANCE

⚠ WARNING

DISASSEMBLY

Refer to the Exploded View and Cross Sectional View drawings on pages 8 & 10.

Begin by separating the motor sub-assembly and nose assembly from the gear box.

- Support the starter motor with the nose assembly facing in a downward position, resting mounting flange on an appropriate support.
- Remove screws (17) and (18) and remove cover plate (15) by lightly tapping sideways with a soft hammer to break the sealing gasket.
- Remove spacer (46) and idler gear (45).
- Remove screws (16) and push motor assembly (7) from gear box (25).

The sub-assemblies may now be dismantled separately. Disassembly of any of these two sub-assemblies is detailed in the Exploded View on page 8 and is basically in the order shown. Refer also to the following instructions:

NOSE ASSEMBLY

1. Secure pinion (39) in vice using soft jaws and remove retaining screw (40) and pinion (39) from drive assembly (31).

2. Support the starter motor, as previously mentioned and remove screws (23). The nose assembly will now spring apart.

3. Remove nose housing (34), spring (32), drive assembly (31) and piston (28).

4. Remove bearing (35) and seal (38) using a suitable pressing tool.

5. Support gear cover (25), remove circlip (19) with circlip pliers, remove gear (20).

6. Using a soft hammer knock out the drive shaft (30) through bearing (22) and seal (24).

7. Remove circlip (21) using circlip pliers.

8. Remove seal (24) and bearing (22) from gear cover (25) using a suitable pressing tool.

MOTOR ASSEMBLY

1. Remove the four screws (1) and cap (2).

2. Invert motor assembly and hold gear (13) in a vice using soft jaws.

3. Remove nut (3) and place motor assembly on bench.

4. Support motor housing (7) and lightly tap threaded end of rotor (9) which will remove end cover (10) and rotor (9) as an assembly.

5. Support end cover (10) and remove circlip (14) using circlip pliers, press rotor out through gear (13) and bearing (11).

6. Remove circlip (12) using circlip pliers and press out bearing (11).

7. Remove six screws (5) support motor housing (7) using a soft drift, tap end cover (6) away from motor housing (7).

8. Support end cover (6) and press out bearing (4).

INSPECTION

Refer to the Exploded View and Cross Sectional View drawings on pages 8 &10.

1. Visually inspect all parts removed during disassembly for excessive wear or damage. Replace any damaged or questionable parts.

2. Pay particular attention to the slots in the rotor (9) for excessive wear, also the condition of the motor housing liner for excessive wear and scoring. If excessive scoring has occurred or the liner has irregular wear patterns, honing of the motor housing liner is required.

Serviceable limits as follows:

- 2.802 – 2.807 inches
- 71.18 – 71.30 metric

3. Also pay particular attention to all gear teeth looking for cracked or broken teeth and excessive wear. Check the pinion on the drive assembly (39) for evidence of unusual contact patterns resulting from misalignment or improper engagement. Remove any burrs or replace if questionable.

4. Check all bearings are free to rotate and do not have excessive play between races. If in doubt replace questionable bearings.

CAUTION

Do not wash shielded bearings that are to be reused in solvent or blow with compressed air as it may remove internal lubrication. Bearings that are to be reused should be cleaned by wiping the end shields with a clean cloth.

5. Clean all other parts that are going to be reused with commercially approved solvents.

WARNING

Ensure cleaning operations are carried out in a properly vented area away from open flames.

6. It is recommended that when servicing your AUSTART Turbine Starter always replace complete repair kit contents.

REASSEMBLY

Refer to the Exploded View and Cross Sectional View drawings on pages 8 &10.

Reassembly of any of the sub assemblies detailed in the Exploded View on *page 8* is basically in the reverse order shown. Refer also to the following instructions:

NOSE ASSEMBLY

1. Begin by pressing the bearing (35) and seal (38) into front housing (36) using a press with an appropriate pressing tool.

2. Drive home the seal (24) into the gear cover (25) until it bottoms.

CAUTION

Ensure the seal (24) is fitted the correct way ie. with the tapered leading edge engaged first. Liberally grease the exposed side of the seal (24) with lithium based grease such as Valvoline Valplex EP grease or similar.

3. Using a press drive home the bearing (22) into the gear cover (25) until it bottoms. Then insert shaft (30) into the bearing (22) and press home. Ensure the gear cover (25) and bearing (22) are well supported during this operation. Finally fit circlip (21) using circlip pliers.

4. Invert the gear cover (25) and restrain in the vertical position. Slip on gear (20) onto shaft (30) and fit circlip (19) using circlip pliers.

5. Invert partial assembly again to fit o'rings (26) and (33) onto gear cover (25).

6. Fit o'ring (27) and wiper seal (29) onto piston (28).

7. Liberally grease piston (28), the inner portion of the gear cover (25) and shaft (30) where it extends, then gently slide piston (28) onto the gear cover (25) without damaging o'ring (26).

8. Slide drive assembly (31) onto shaft (30) and then fit spring (32) over drive assembly (31).

9. Liberally coat the inner regions of rear housing (34) with grease and assemble over piston (28) taking care not to damage wiper seal (29). Rotate the nose assembly until the two screw holes line up with the gear cover (25).

10. Squeeze together gear cover (25) and rear housing (34) being careful not to damage o'ring (33) and then insert screws (23).

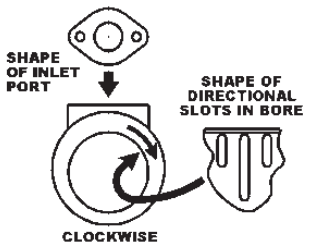
11. Assemble pinion (39) on to drive assembly (31) and apply Loctite 243 or similar to screw (40) and retighten pinion (39).

The nose assembly is now ready to accept the motor assembly.

MOTOR ASSEMBLY

1. Install baring (4) into end cover (6) and bearing (11) into end cover (10).

2. Confirming direction of air starter. For clockwise air starters refer diagram below. Start by placing motor housing (7) on bench with the three intake directional slots facing to the right.



3. Apply a thin layer of liquid gasket such as Loctite 515 or similar to mating face of motor housing (7).

4. Knock on end cover (6) with a soft hammer and insert the six screws (5).

5. Invert the motor housing (7) and support bearing (4) and end cover (6).

6. Press rotor shaft (9) into bearing (4) insert blades (8) into rotor shaft (9) slots making sure blades (8) are pushed out towards motor housing liner. Apply thin layer of liquid gasket such as Loctite 515 or similar to mating face of motor housing (7)

7. Insert end cover (10) and bearing (11) over rotor shaft (9) with an appropriate tool. Press home end cover (10) and bearing (11).

8. Fit circlip (12) using circlip pliers and push on gear (13) then fit circlip (14).

9. Invert motor assembly and hold gear (13) in vice using soft jaws.

10. Apply oil to thread of rotor shaft (9) and install nut (3). Tighten nut to a torque of 25-30 ftlb (30-40Nm).

11. Apply a thin layer of liquid gasket to cap (2) and mount end cover (6) with four screws (1).

ASSEMBLING NOSE & MOTOR ASSEMBLIES

1. Start by fitting circlip (12) into idler gear (45) using circlip pliers.

2. Press home bearing (11) and fit circlip (12) using circlip pliers.

3. Invert nose assembly and assembly motor sub assembly into gear cover (25). Line up orientation of motor assembly and install screws (16).

4. Insert gear assembly (45) onto idler pin (43) and fit spacer (46).

5. Apply a liberal amount of grease to gears (20), (45) and (13).

6. Apply a thin layer of liquid gasket such as Loctite 515 or similar to mounting face of gear cover (25). Replace cover plate (15) and retighten with screws (17) and (18).

7. Test the operation of the dive assembly (31) by introducing air pressure at the control line inlet port. The drive assembly should move freely forward when air pressure is applied and back once the pressure has been relieved. Investigate if this movement is not smooth.

8. Apply lubricating oil into port of motor housing (7) attach air line and test operation of air motor.

The AUSTART air starter is now assembled and ready for installation. Refer Installation and Operation section of this manual.

WARRANTY POLICY

All Austart Products supplied by K.H. Equipment Pty. Ltd. (herein called "the Manufacturer") is warranted to be free from any defect in workmanship and material under conditions of normal use and service for engine starting applications for a period of 12 months from the date of purchase by the first user. Normal wear and tear is excluded from the warranty cover.

The Manufacturer will replace or repair at their works, without cost, any Austart Starter or parts found to be defective or at their discretion choose to refund the purchase price less a reasonable allowance for depreciation in exchange for the starter or part should the item prove impossible to repair or replace.

This warranty shall not apply to any Austart Starter or parts which have been altered or repaired or purchased outside the Manufacturer and its assigned agents nor to equipment or parts that have been subject to misuse including overloading, neglect, accident or damage, nor to any part or parts improperly applied or installed.

This warranty is in lieu of all other warranties and conditions statutory or otherwise expressed or implied and of all other obligations or liabilities on the Manufacturer's part. The Manufacturer's maximum liability is limited to the purchase price of the starter and is not liable for any consequential damage, loss or expense.

Repeat engine starting attempts must be delayed for 15 seconds to allow all Austart Starter and engine components to stop rotating to avoid damage or adverse wear of components.

NOTES

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