LGH
THE LIFTING EXPERTS

OPERATION MANUAL

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RAM WINCH HOIST™

Instructions, Parts and Maintenance Manual

Model AW3B-12AX5-T

AIR WINCH

Electric Over Air
REMOTE CONTROL

Warning!

Review* "WINCH OPERATING PRACTICES" *Prior to use.

Always operate, inspect and maintain this winch in accordance with American National Standards Institute Safety Code (ANSI B30.7) and any other applicable safety codes and regulations.

This winch is only a component of the lifting system, which must be designed by qualified personnel.

14603 CHRISMAN HOUSTON, TEXAS 77039 (281) 999-8665 FAX: (281) 999-8666 or (888) 726-5438

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WARNING TAG

Read the latest edition of ASME B30.7. Comply with all Federal, State and local rules.

It is the customer's responsibility to use this winch with adequate factors of safety for the rated load, plus the weight of the winch and attached equipment.

A registered structural engineer should review handling procedures.

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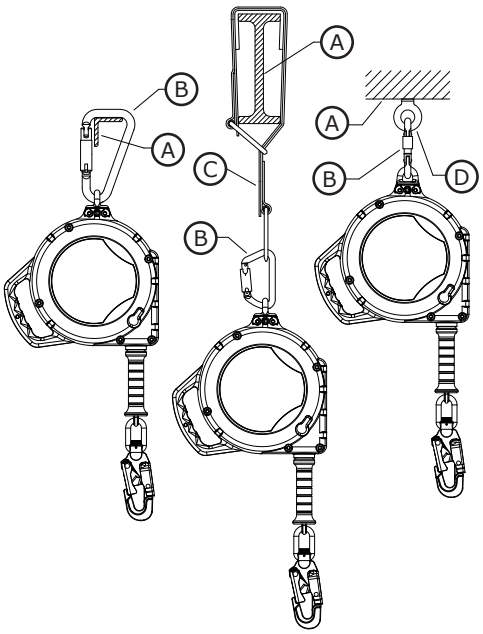

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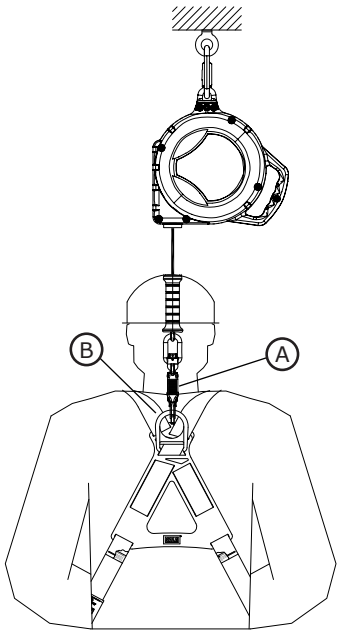

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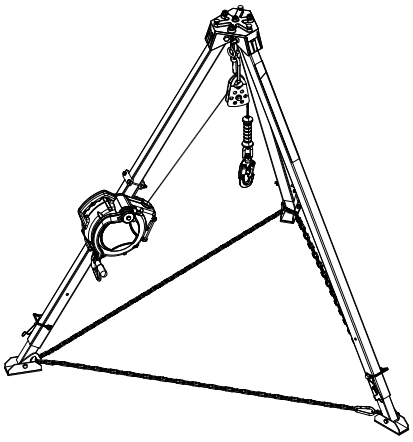
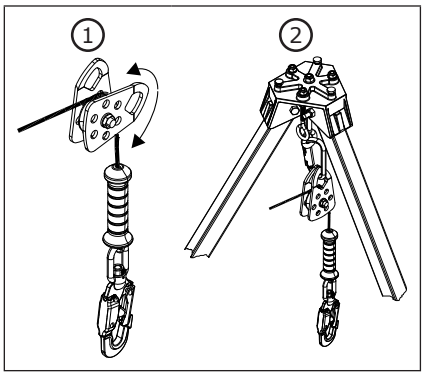
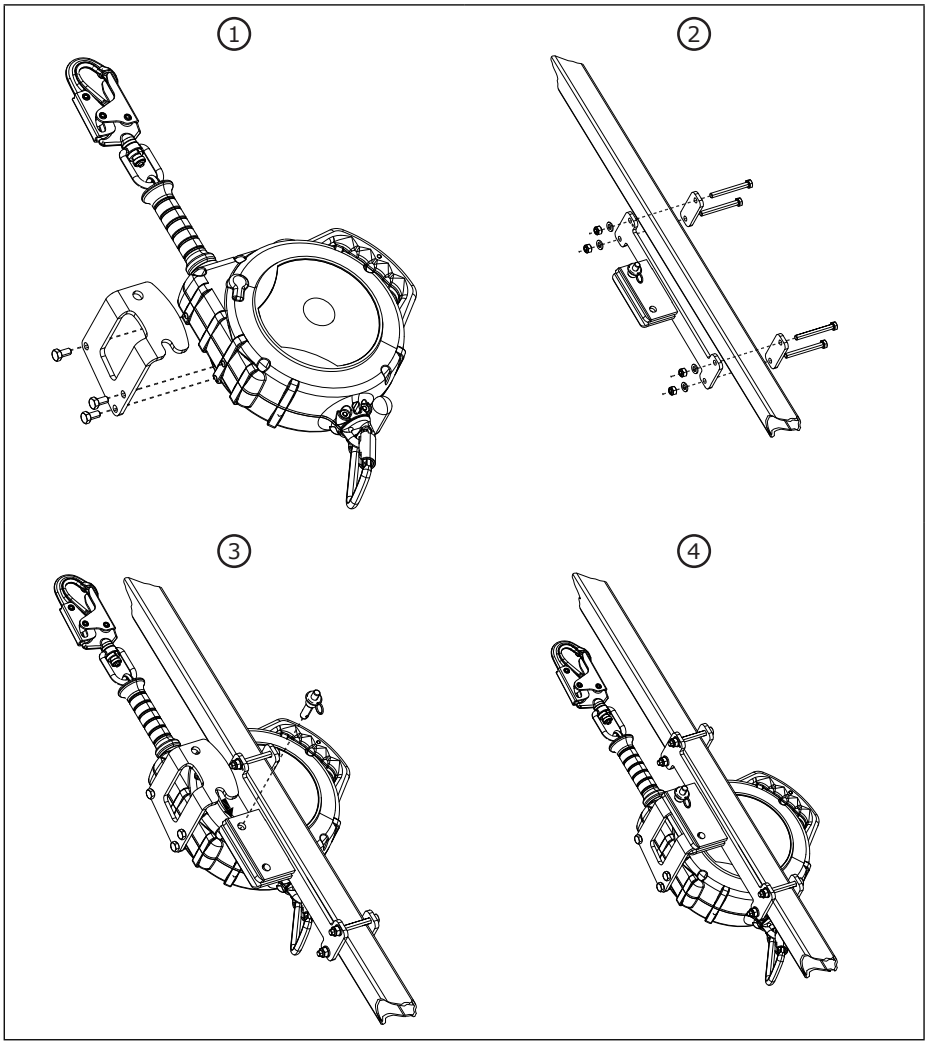






GENERAL GUIDELINES FOR SAFE OPERATION

The following warnings and precautions should be taken to ensure safe operating conditions.

Failure to remain alert and keep equipment in good operating condition could result in personal injury or death. To avoid such, please read and understand this manual as well as all applicable laws and requirements for safe operation.

Keep a copy of this manual with the equipment at all times.

Be certain all operators of the equipment have been properly trained in the use of the equipment and have read the owners manual thoroughly.

Keep hands, feet and any loose clothing away from rotating or moving parts. Never operate the equipment without the proper guards or safety equipment required for a complete winch system.

When maintaining the equipment, be sure to tag out of service on supply power to prevent accidental operation or activation.

Do not alter or modify the equipment in any way without first contacting **RAM Winch & Hoist** Engineering Department as to the alteration type or extent. Failure to do so could result in damage to the equipment or injury to personnel.

Keep all warning tags on winch in good legible condition and placed in areas on the unit that are highly visible and especially close to areas which could be considered hazardous.

This winch is a component of a lifting system. The complete lifting system is the purchaser's or user's responsibility and all safety guards, regulators, mufflers, wire rope or any other items required for a safe system must be specified and installed by same. Failure to do so may result in severe injury, property, damage, or death.

The wire rope, drum guard, regulator and mufflers are available and can be supplied with the unit at an additional adder. Some models come equipped with some or all of these items. Check with your supplier to determine what your specific unit is supplied with as standard.

If you are unsure of your system or the requirements for safe operation, we recommend you consult with OSHA, ANSI, ASME, API or any other accredited association or a professional engineering firm.

WINCH OPERATING PRACTICES

1. Read the manufacturer's instructions before operating the winch.
2. Always inspect, test maintain and operate this winch in accordance with American National Standards Institute Safety Standards B30.7.
3. Never Lift a load greater than the rated line pull of the winch.
4. Use the recommended size wire rope for load to be handled.
5. Never use the wire rope as a sling.
6. Always stand clear of the load.
7. Unless the winch is designed for personnel handling, never use this winch for lifting or lowering people, and never stand on a suspended load.
8. Never carry loads over people.
9. Never disengage the clutch with a load applied to the winch.
10. Never engage the clutch with the winch motor running.
11. Always rig the winch properly and carefully, making certain the wire rope is properly anchored to the drum.
12. Before each shift, check the winch for wear or damage. Check the brakes, wire rope, hooks, guides, mounting bolts, etc. Lift a capacity load or a near capacity load a few inches off the floor and check the ability of the braking system to stop and hold the load without excessive drift, if the winch is being used for lifting.
13. Never operate a winch with a twisted, kinked or damaged wire rope.
14. Periodically inspect the winch thoroughly and replace worn or damaged parts. Keep accurate records of all inspections and repairs.
15. Follow the lubrication instructions provided by the manufacturer.
16. Do not attempt to repair the wire rope or hooks. Replace hooks when there is a 15% increase in the throat opening or when there is a 10% bend as shown by inspection records.
17. Keep the rope clean and well lubricated. Replace wire rope that is frayed.
18. Ease the slack out of the wire rope when starting. Do not jerk the winch.
19. If the drum is exposed to personnel walkways, place a guard over the drum.
20. Do not use your hands to guide the rope onto the drum when winding in the wire rope.
21. Be certain there are no objects in the way of the load or hook when operating the winch.
22. Do not use higher air pressure than recommended by the manufacturer.
23. Use compressed air carefully. Be sure the hose couplings are secure, and make certain a safety chain is provided to avoid hose whip if the coupling fails.
24. Wear proper clothing to avoid entanglement in rotating machinery.
25. Be certain the air supply is shut off before performing maintenance on the winch.
26. Properly secure a winch before leaving it unattended.
27. Do not leave a load suspended for any extended period of time. Never leave a suspended load unattended.
28. Do not allow unqualified personnel to operate a winch.
29. Do not operate a winch if you are not physically fit to do so.
30. Do not divert your attention from the load while operating a winch.
31. Be certain the load is properly seated in the saddle of the hook. Do not tip load the hook as this leads to spreading and eventual failure of the hook.
32. Do not force a hook into place by hammering.
33. Never operate a winch beyond the point where less than four wraps of wire rope remain on the drum.
34. Do not use the wire rope as a ground for welding. Do not attach a welding electrode to a winch or sling.
35. Never operate a winch that makes excessive mechanical noise. Report the problem immediately.

Post at Operating Station

1.0 General Information:

1.1 User Responsibility and Safety Precautions

This equipment will perform in conformity with the description thereof, contained in this manual, its accompanying labels and/or inserts when it is installed, operated, maintained and repaired according to the instructions provided. This equipment must be checked periodically.

Deficient equipment should not be used. Parts that are broken, missing, plainly worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, we recommend that a telephone or written request for service be made to **RAM Winch & Hoist**.

This equipment or any of its parts should not be altered without prior written approval of **RAM Winch & Hoist**. The user of this equipment shall have the sole responsibility for any malfunction that results from improper use, faulty maintenance, damage, improper repairs or alterations made by anyone other than **RAM Winch & Hoist**.

1.2 Introduction

1.2.1 Purpose

The purpose of this manual is to provide operating instructions and maintenance procedures for your **RAM Winch & Hoist** winch.

1.2.2 Model Number, Serial Number and Options

This manual covers the winch built by **RAM Winch & Hoist** for your particular unit. The model number and serial number are listed on the nameplate attached to the unit.

1.2.3 Warranty

See standard warranty certificate.

1.3 Equipment Description

1.3.1 Capabilities and Limitations

The winch is an air, planetary driven cable-handling unit, with spring set, pressure release parking brake designed for use in the marine or industrial environment.

1.3.2 Specification and Descriptive Data

Working Line Pull	**See Performance Chart**
Cable Capacity	**See Performance Chart**
Line Speed	**See Performance Chart**
Construction	All welded steel with steel hardware.
Finish	Sandblasted to near white metal. Primer coated with inorganic zinc to 2-3 mils DFT. Top coated with a Carboline marine coating system.
Bearings	Spherical roller-type flange mounted bearings.
Drive System	A piston-type air motor, which is coupled to a planetary gear reducer.
Controls	Air control valve on motor.
Braking System	An automatic brake (brake band type). **!!WARNING!!** ***Do not manually release the brake if a load is held suspended by the winch!***
Performance	Bare drum rating as indicated on winch nameplate is the maximum allowable load.

2.0 Functional Description

2.1 Major Assemblies

The winch consists of the following major assemblies:

a. Drive assembly
b. Frame and drum assembly

2.1.1 Drive Assemblies

The drive assemblies consist of:

a. Air motor to brake to gear reducer assembly
b. Gear reducer to drum assembly

3.0 Installation Instructions

3.1 Site Selection

The winch should be installed in a location that meets the following requirements:

⇒ Firm foundation that allows the unit to be welded or bolted down to withstand a minimum of 5 times the rated line pull of the winch.

⇒ Accessibility for the operator.

⇒ Protection from heavy falling objects.

⇒ Near an adequate air supply source.

⇒ As far as possible from the first turn sheave.

⇒ Out of the way of other operations.

3.2 Handling

Lifting the unit on the topside of the frame side plate (via lifting eyes) or under the frame structure will accommodate standard lifts.

**** CAUTION ****

DO NOT LIFT WINCH BY CABLE DRUM – DAMAGE TO CABLE AND/OR BRAKE ASSEMBLY MAY RESULT

3.3 Installation Procedures

3.3.1 Welding / Bolt Down

When the winch is at or near the desired location, remove the shipping protection and position it exactly. If the winch is to be welded down, a qualified welder should be used. All exposed metal surfaces should be painted immediately after welding to inhibit rust.

You must have a qualified engineer to determine the amount of weld required to securely hold the winch. If the unit is bolted down, be sure to use the proper size and a minimum of Grade 5 bolts and torque to the proper setting.

**** CAUTION ****

Extreme care should be taken to orient the center of the winch drum and exactly perpendicular to the cable running to the first sheave. This can be done by average sightings along the flat surface of the winch sidewall, drum flanges or with the help of a square to find the true perpendicular centerline. If it is not properly aligned, cable-laying problems may create difficulties and possibly damage the cable, winch and/or personnel.

3.3.2 Requirements Prior to Start Up

Check gearbox lubrication for proper oil level. If it is low, then fill to level mark on side. Fill with standard 90-wt. gear oil. Check lubricator on air supply line for proper oil level. If low, then fill with 30-wt. oil.

Be certain all hoses and fittings are tightened and not leaking.

3.4 Installation Checkout

3.4.1 Phase I – Installation Inspection

⇒ Check all bolts and fasteners to ensure that they are tightened properly.

⇒ Grease all bearings.

⇒ Test brake release / set with no load on the drum to ensure operating properly.

3.4.2 Phase 2 – Start Up and Preliminary Tests

⇒ Leaks – All fittings and hoses have been inspected for leaks at the factory prior to shipment. If leakage is noticed, tighten or replace as required to correct.

3.5 Cable Installation

3.5.1 Cable Termination on Drum

A cable lead-in slot is cut into the drum to allow termination inside the drum. A cable wedge is placed in the drum pocket provided to constrain the cable.

**** CAUTION ****

This wedge is not intended to take full line pull on the cable.

3.5.2 Spooling Cable onto Drum

**** CAUTION ****

Spooling of the cable must be done very carefully. To prevent injury, keep hands, clothing and anything that could catch on or get caught in the cable clear when the drum is rotating. This would pull the item or person into the cable spooling onto the drum. Since spooling of the cable requires at least two people, an operator and someone to guide and control the cable, they must stay alert and maintain visual contact with each other at all times. Qualified and experienced personnel should only do this.

For units with level wind, refer to spooling device instructions.

Bring the cable over the drum and through the hole in the drum wall. Position the cable so it wraps around the wedge to secure the cable in the tapered slot. Handling and wrapping cable onto the drum must be attended by a gloved operator to make certain that the cables lie on the drum properly.

The cable must not stack up above the drum flanges or it will fall off the side of the drum and possible damage the cable. Whenever the equipment is being raised, the winch operator must watch for the end of the cable markings or the equipment itself. Before the equipment gets near the sheave, the operator should stop the winch.

4.0 Operating Instructions

4.1 System Description

The **RAM Constant Tensioning Remote Control System** consists of remote mounted Control Console(s) housing electrical controls for the winches. The electrical controls control the operation of the pneumatic solenoids and control valves in the separate Pneumatic Controls enclosures mounted on the winches. The operational controls on multi-unit Control Cconsoles are grouped by unit number and operate multiple winches individually.

4.2 Operational Description

The controls for each winch unit provide options for Manual (joystick) Control or Constant Tensioning Control in the "Inhaul" direction of operation. In the Manual Control mode, the Inhaul speed is controlled by the joystick.

In the Constant Tensioning mode, the Inhaul speed or tension range is dictated by the manual adjustments of the Secondary Control Regulator and the Back Pressure Relief Regulator, and precisely controlled by the pilot air pressure to the two regulators. The pilot air to the regulators is metered by the output of the Proportional Output valve (PCV1) which in turn is controlled by the setting of the Constant Tension adjustment potentiometer.

! WARNING !

Switching from Manual Mode to the Constant Tension mode will immediately fully *release* the winch brake, and switching from Constant Tension to Manual will immediately *set* the winch brake. It is therefore important to position the Constant Tension adjustment potentiometer to a previously proven safe position to assure stability when switching from one mode to the other under load.

4.3 Levelwind Operation If Applicable

If this unit is outfitted with an active-type levelwind with air drive control and a manual override system. Prior to operation, the levelwind guide shafts should be cleaned and re-greased.

Clean the shafts with Varsol or some other mild grease remover. Apply a thin coat of grease all over the shafts. The level wind should be covered when the unit is not in use. The acme drive screw should also be cleaned and greased. All the rollers on the carriage should be greased also.

Check the small sensor rollers to make sure that they are free to turn and also to make sure that the sensor mechanism is working properly and free to move. If any rollers

are not moving freely and the cable drags across it, this will create a flat spot on the roller. If this happens, the roller will need to be changed out.

4.3.1 Automatic Operation of Levelwind if Applicable

This levelwind system is normally in the automatic mode and only requires the operator to visually monitor the cable lay for correct spooling and proper operation.

This system senses the cable angle and is driven by the offset of the cable angle.

As the cable comes through the guide rollers and then through the sensing mechanism and onto the winch drum, it lays beside the preceding wrap. As this continues, the angle of the wire rope between the levelwind guide roller and drum wrap changes or get offset at a larger angle.

This causes the sensing mechanism to also become offset to a point that activates the unit to drive the carriage towards the direction of offset and reduce the cable angle between the levelwind roller and drum wrap.

4.3.2 Manual Operation of Levelwind if Applicable

There is a manual override system for the levelwind to allow for adjustment, if required, and for placing the carriage in the proper position for installing cable. The unit always has air present for the automatic mode. The ball valve must be opened to activate the manual mode. The manual mode is then controlled by the manual control valve mounted on the levelwind. In some cases if may be necessary to disable or block the control air to the automatic mode. This is OK to do but pay close attention to the automatic sensing mechanism to prevent damage form over travel against the wire rope with heavy loads. Light loads or cable weight only will have no effect. Once you finish using manual mode be sure to close the ball valve to prevent accidental activation.

5.0 Maintenance Procedure

5.1 Introduction

This section gives necessary information for regular periodic and preventive maintenance, and for some repairs or replacements. For further information, service assistance or problems, call **RAM Winch & Hoist** Service Department.

5.2 Maintenance Plan

5.2.1 Lubrication Schedule

Under normal operating conditions on a permanent installation, the following lubrication schedule is recommended:

1. The gear reducer is filled with oil at the factory. Change after the first 500 hours of operation, drain and refill with EP-90-wt. lubricant. Repeat yearly.

2. Lubricate the bearings with Lubriplate 130AA or equivalent at 500-hour intervals.

3. **WARNING:** ***Lubricate the motor before operating the winch***. To avoid leakage during shipment, drain all oil from the motor. A sufficient quantity of oil for filling each unit is packed with the winch. Make certain the proper lubricant is used for each unit. Make certain the oil level plugs and drain plugs are securely threaded into place. Remove the vent cap and oil level plug. Pour the recommended oil into the motor case until it starts to come out the level plug hole. Replace the level plug and vent cap.

Motor Lubrication

Check oil daily and maintain level with opening in the side of the motor case.

When the winch is subject to temperatures above freezing: After the winch has been idle for several hours or overnight, loosen the drain plug located at the bottom of the motor case and allow the accumulated water to drain out. After draining the water, tighten the plug in the bottom and remove a similar plug on the side of the motor case. Unscrew the vent cap and pour a sufficient quantity of the recommended oil through this opening to bring the oil level up to the side opening.

When the winch is subject to freezing temperatures: Allow the winch to remain idle long enough for the water content in the motor case to separate from the oil, but not long enough for it to freeze. Drain the water and replenish the oil as above. Should this procedure be impractical, drain the entire contents of the motor case immediately after operation ceases, and pour the oil back into the motor case before resuming operation. If not drained, a sufficient quantity of water will eventually accumulate and the oil splasher will freeze fast.

For temperature 30^{o} to 80^{o}F (-1.1^{o} to 26.2^{o}C) use SAE 20 or 20W motor oil.
For temperature below 30^{o}F (-1.1^{o} C) use SAE 10 or 10W motor oil.
For temperature above 80^{o}F (26.6^{o}C) use SAE 30 motor oil.

4. Check the air supply lubricator prior to running and during operation. Do not operate without oil in the lubricator as this may damage the air motor.

5.2.2 Cleaning

The winch will last longer and be easier to maintain if it is kept relatively free of oil, dirt, and rust. Rinsing as often as possible with fresh water will help minimize corrosion.

5.2.3 Cables and Hoses

All hose assemblies in service should be checked periodically for leaks, abrasions, kinks, cover blister or other damage. Assemblies showing signs of wear or damage must be replaced before they cause failure or create a hazard.

6.0 Component Removal / Replacement

Maintenance of the winch consists of determining the defective part and removing or replacing that component. All work should be done only after the air supply is shut off and tagged *Out of Service*. If needed, consult with **RAM Winch & Hoist,** or its nearest trained representative for service.

APPENDICES

Parts Ordering Information

When ordering parts, please provide the model and serial number for your unit.

If possible, please supply us with the original purchase order and call RAM Winch & Hoist Parts Department at (281) 999-8665 or fax your order to (281) 999-8666.

For your convenience and future reference please take a few moments to add the following information:

Model Number AD-HP-37-60

Job/Serial Number 4518

Date Purchased 5/13/05

RAM PARTS DEPARTMENT

Phone 281-999-8665 Fax 281-999-8666

Email: ramwinch@ramwinch.com

RAM

WINCH AND HOIST

Winch Model AW3B-12AX1

MOTOR HP	40.0	**Motor Speed**	760			THE ACCUMULATED CAPACITY MEETS ANSI B30.7 WHICH REQUIRES A 1/2-INCH FLANGE CLEARANCE. THE UNSHADED CAPACITIES MEET EUROPEAN STANDARDS REQUIRING 2 1/2 DIAMETERS OF FLANGE CLEARANCE
Line Pull lbs	20000	**Line Speed(fpm)**	55	**10th Layer**		
Wire Rope dia	7/8	**Length, ft**	895	**No. of Layers**	11.0	
		Drum Dia., in	16	**Flange Dia**	35.25	
Drum Width	12.0					
				No. of Wraps	13	

Layer No.	Capacity (ft)	Accumulated Capacity (ft)	Pitch Dia (in)	MAX Hp Line pull (lbs)	MAX Hp Speed (fpm)	Flange Clearance	Stall Line Pull (lbs.)	Start Line Pull (lbs.)	FPM AT F.S.
1	56	56	16.9	36899	30.4	8.4	56320	44039	72
2	61	117	18.4	33856	33.1	7.7	51676	40408	78
3	66	184	19.9	31277	35.8	6.9	47739	37330	85
4	71	255	21.4	29063	38.6	6.2	44360	34687	91
5	76	331	22.9	27142	41.3	5.4	41428	32394	98
6	81	413	24.5	25459	44.0	4.6	38859	30385	104
7	86	499	26.0	23972	46.8	3.9	36590	28611	111
8	91	591	27.5	22650	49.5	3.1	34572	27033	117
9	97	687	29.0	21466	52.2	2.4	32764	25620	124
10	102	789	30.5	20399	55.0	1.6	31136	24347	130
11	107	895	32.0	19434	57.7	0.9	29662	23194	137

RAM

WINCH AND HOIST

Winch Model AW3B-12AX1

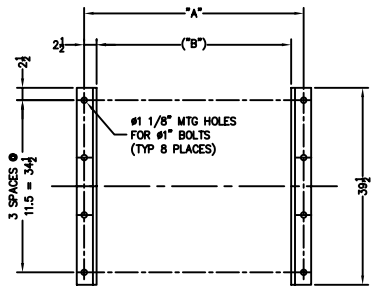
Line Pull lbs	20000	**Line Speed(fpm)**	55	**10th Layer**		THE ACCUMULATED CAPACITY MEETS ANSI B30.7 WHICH REQUIRES A 1/2-INCH FLANGE CLEARANCE. THE UNSHADED CAPACITIES MEET EUROPEAN STANDARDS REQUIRING 2 1/2 DIAMETERS OF FLANGE CLEARANCE
Wire Rope dia	3/4	**Length, ft**	1004	**No. of Layers**	11.0	
		Drum Dia., in	16	**Flange Dia**	35.25	
Drum Width	12.0					
				No. of Wraps	15	

Layer No.	Capacity (ft)	Accumulated Capacity (ft)	Pitch Dia (in)	MAX Hp Line pull (lbs)	MAX Hp Speed (fpm)	Flange Clearance	Stall Line Pull (lbs.)	Start Line Pull (lbs.)	FPM AT F.S.
1	66	66	16.8	34954	32.1	8.6	56740	44368	76
2	71	137	18.0	32437	34.6	7.9	52654	41173	82
3	76	213	19.3	30258	37.1	7.3	49117	38407	88
4	81	294	20.6	28353	39.5	6.6	46025	35989	94
5	86	380	21.9	26674	42.0	6.0	43299	33858	100
6	91	471	23.2	25183	44.5	5.3	40878	31965	105
7	96	568	24.5	23849	47.0	4.7	38714	30272	111
8	101	669	25.8	22650	49.5	4.0	36767	28750	117
9	107	776	27.1	21566	52.0	3.4	35007	27373	123
10	112	887	28.4	20580	54.5	2.7	33407	26122	129
11	117	1004	29.7	19681	57.0	2.1	31947	24981	135

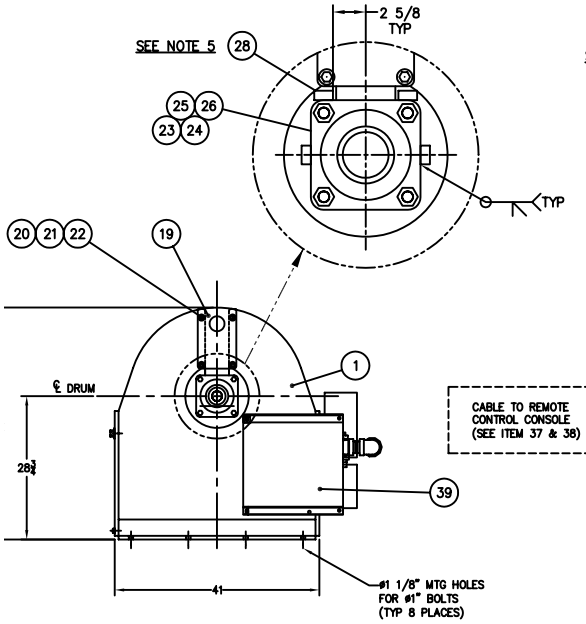
1	2	3	4	5				6
REVISIONS				DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L
DESCRIPTION	DATE / ECN NO.								

TABLE 1 – DIMENSION/WEIGHT					
WINCH P/N	DIM "A"	DIM "B"	DIM "C"	DIM "D"	WT. LBs
AW3B/AW2.8B/AW2.5B-12	32.00	27.00	35.00	53.25	3770
AW3B/AW2.8B/AW2.5B-24	44.00	39.00	47.00	65.25	4318
AW3B/AW2.8B/AW2.5B-36	56.00	51.00	59.00	77.25	4868
AW3B/AW2.8B/AW2.5B-42	62.00	57.00	65.00	83.25	5144

TABLE 1A – AW MODELS & CORRESPONDING GEAR BOX P/N					
AW MODEL	ITEM	QTY	PART NO.	DESCRIPTION	WT.#
AW3B	3	1	AH00315	TORQUE HUB ASSY, CT35A11	335
AW2.8B	3	1	AH00314	TORQUE HUB ASSY, CT35A11	335
AW2.5B	3	1	AH0000X	TORQUE HUB ASSY, CT35A11, 71:1 RATIO	335

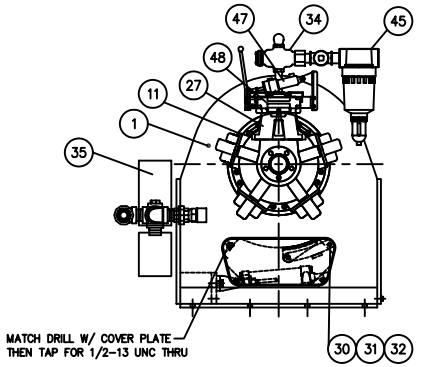


WINCH FOOT PRINT



BEARING SIDE ELEVATION

REAR ELEVATION



DRIVE SIDE ELEVATION

ASSEMBLY NOTES:

1] APPLY ANTI-SEIZE COMPOUND ON ALL MOUNTING BOLTS.

2] THE FOLLOWING TORQUE VALUES SHOULD BE USED:
- FOR 3/8"-16 UNC W/ NUT.....19 FT-LBS
- FOR 3/8"-16 UNC W/O NUT.....23 FT-LBS
- FOR 1/2"-13 UNC W/ NUT.....45 FT-LBS
- FOR 1/2"-13 UNC W/O NUT.....54 FT-LBS
- FOR 5/8"-11 UNC W/ NUT.....88 FT-LBS
- FOR 5/8"-11 UNC W/O NUT.....107 FT-LBS
- FOR 3/4"-10 UNC W/ NUT.....160 FT-LBS
- FOR 3/4"-10 UNC W/O NUT.....192 FT-LBS
- FOR 3/4"-16 UNF W/ NUT.....180 FT-LBS
- FOR 3/4"-16 UNF W/O NUT.....216 FT-LBS
- FOR M20 X 1.5P W/ NUT.....190 FT-LBS
- FOR M20 X 1.5P W/O NUT.....225 FT-LBS
- FOR 1"-8 UNC W/ NUT.....390 FT-LBS

3] GREASE ALL BEARINGS WITH MULTI-PURPOSE GREASE.

4] HALF FILL TORQUE HUB W/ 90 WEIGHT GEAR LUBE

5] AFTER DRUM ALIGNMENT HAS BEEN ESTABLISHED, IT WILL BE NECESSARY TO WELD RETAINER LUGS AT LOCATIONS SHOWN TO MAINTAIN BEARING POSITION.

6] REMOVE AUTO-DISC BRAKE FROM INSIDE TORQUE HUB PRIOR TO INSTALLATION.

WINCH ASS'Y (w/o WIRE ROPE) WT. – SEE TABLE

TOLERANCE UNLESS OTHERWISE SPECIFIED	PAINT SPEC.	DO NOT SCALE	This drawing and all copies and the design and data shown include proprietary information and are the property of RAM ITC. The borrower by receipt and retention of the drawing agrees that except as expressly authorized in writing	CUSTOMER:	DRAWING TITLE: WINCH GENERAL ASSEMBLY (R.I
		DRAWN BY: CTC		CUSTOMER P.O. NO.:	MODEL: AW3B/AW2.8B/AW2.5B

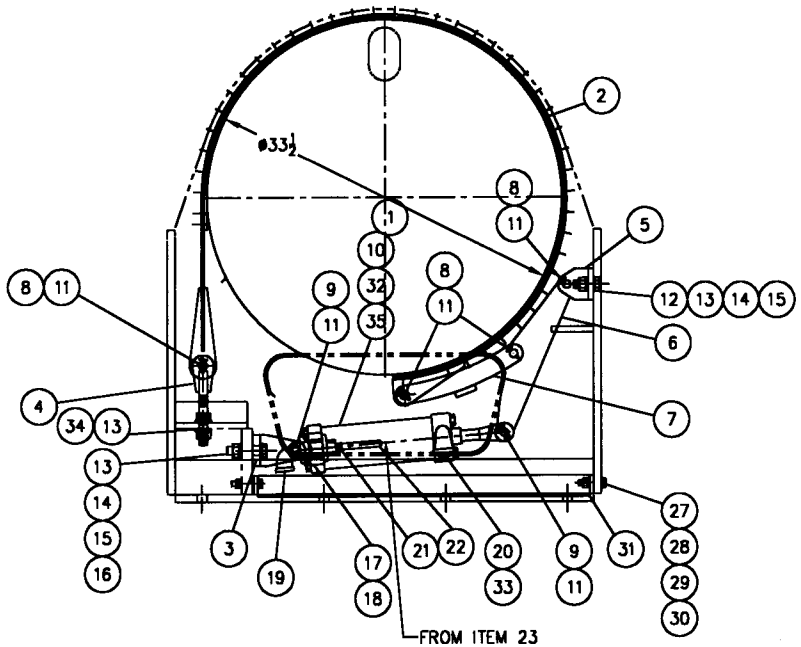
1	2	3	4	5	6

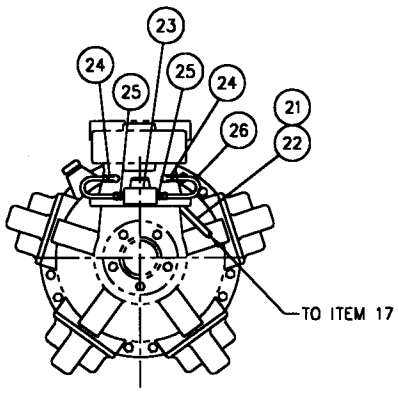
REVISIONS		
DESCRIPTION	DATE	ECN NO.

DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L
404833	1	1	AG	FRAME, R.H.	C.S.
403024	2	1	AG	DRUM, ø16"	C.S.
	3	1		SEE TABLE 1A	
	4	20	FQ04108	5/8–11x2 3/4LG SKT HD CPSCRW, TEFL	GR5
	5	32	FQ11250	5/8 LWSHR, PLT'D	C.S.
401942	6	1	AG01942	SHAFT, SPLINED INTERFACE	C.S.
401949	7	1	AG01949	ADAPTER PLATE	C.S.
	8	2	AG00913	SEAL,2 3/4 ODx ø1 3/4 SHAFT(#66X0913)	
	9	20	FQ05270	M20x1.5Px50MM LG SKT HD CPSCRW, TEFL	GR5
	10	20	AG20024	M20 LWSHR, PLT'D	C.S.
	11	1	AF50000	PENTADOME MOTOR W/ REMOTE CONTROL	
	12	10	FQ04093	5/8–11x2 1/4LG SKT HD CPSCRW, BLK	GR5
401734	13	1	AG01734	SEAL PLATE	C.S.
	14	2	FQ05245	M16 x 2P x 32MM LG HHCS, PLT'D	GR5
	15	1	FP11128	1/4"NPT PIPE PLUG	316S
	16	1	FP11360	M12 X 1.5P METRIC PLUG	316S
	17	1	FQ00040	1/2–13 x 3/4 LG CUP POINT SET SCREW	S.S.
404832	18	1	AG	AUTO–BRAKE ASS'Y, ø33 1/2"	
402379	19	1	AG02379	COVER PLATE	C.S.
	20	4	FQ02015	1/2–13 x 2 LG HX CPSCRW, PLT'D	GR5
	21	4	FQ11200	1/2 LWSHR, PLT'D	C.S.
	22	4	FQ12300	1/2–13 HX NUT, PLT'D	GR5
	23	1	AG48047	FLANGE BEARING, UNISPHERE 4 BOLT	C.I.
	24	4	FQ05100	3/4–10 x 3 1/2 LG HX CPSCRW, PLT'D	GR5
	25	4	AG20027	3/4–10 NYLOK HX NUT, PLT'D	GR5
	26	4	FQ10500	3/4 SAE FWSHR, PLT'D	C.S.
401740	27	1	AG01740	VALVE MANIFOLD	
	28	4	AG00011	SQUARE BAR, 3/4 x 1 1/2 LG	A36
402224	29	1	AG00421	WEDGE, MOD. ROPE (3/4")	CI
402742	30	1	AG02742	CYLINDER ACCESS COVER PLATE	CS
	31	5	FQ02005	1/2–13 x 1 LG HX CPSCRW	SS
	32	5	FQ11205	1/2 LWSHR,	SS
403608	33	1	AG03608	GASKET	FIBER
	34	1	AG00182	MAIN POPPET VALVE	
405442	35	1	--	CONSTANT TENSIONING MANIFOLD ASSY	VARIOU
405623	36	1	REFERENCE	REMOTE CONTROL SYSTEM INTERCONNECT	
405624	37	1	REFERENCE	CONTROL CONSOLE 1 ASSY	–
405625	38	1	REFERENCE	CONTROL CONSOLE 2 ASSY	–
405626	39	1	REFERENCE	PNEUMATIC CONTROL BOX ASSY	–
405627	40	1	REFERENCE	ELECTRICAL SCHEMATIC	–
405628	41	1	REFERENCE	PNEUMATIC CONTROLS SCHEMATIC	–
405629	42	1	REFERENCE	WINCH PNEUMATIC SCHEMATIC	–
405630	43	1	REFERENCE	POWER DISTRIBUTION DWG.	–
405404	44	1	–	ENCLOSURE MOUNTING BRACKET	CS
–	45		LB90089	FILTER, 2"	–
–	47	1	AG04725	2–DIRECTION POSITIONER, 1" STROKE	–
–	48	2	AG04713	THROTTLE CONTROL VALVE	–
–	49	1	AH00315	SPEED REDUCER	–

TOLERANCE UNLESS OTHERWISE SPECIFIED	PAINT SPEC.	DO NOT SCALE		CUSTOMER:	DRAWING TITLE: WINCH GENERAL ASSEMBLY (R.H
		DRAWN BY CTC	RAM WINCH HOIST	CUSTOMER P.O. NO.:	MODEL: AW3R/AW3 RR/AW3 5R

REVISIONS		
NO.	DESCRIPTION	DATE APPD.





DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L
402524	1	1	AG02524	BRAKE CYLINDER ASSEMBLY	
404830	2	1	AG	AUTO-BRAKE BAND SUB-ASSEMBLY	
402241	3	1	AG02241	BRAKE BRACKET	C.S.
402242	4	1	AG02242	BRAKE LINK STUD	
402505	5	1	AG02505	PIVOT BRACKET	C.S.
402244	6	1	AG02244	PIVOT ARM	C.S.
402245	7	1	AG02245	PIVOT LINKAGE	C.S.
401941-1	8	4	AG19411	CLEVIS PIN, 3 LG	S.S.
401941-2	9	2	AG19412	CLEVIS PIN, 3 7/8 LG	S.S.
401952	10	1	AG01952	SPRING, ø4.9 X 16 LG I/CYLINDER	S.S.
	11	12	FQ00023	COTTER PIN, ø1/8 X 1 1/2 LG	S.S.
	12	2	FQ05037	3/4-10 X 2 3/4 LG HHCS, TEFL	GR5
	13	6	FQ12753	3/4-10 HX NUT, TEFL	GR5
	14	4	FQ12758	3/4 LWSHR, TEFL	C.S.
	15	2	FQ12757	3/4 FWSHR, TEFL	C.S.
	16	2	FQ05076	3/4-10 X 3 1/4 LG HHCS, TEFL	GR5
	17	1	AG70252	QUICK EXHAUST VALVE (#EV25A2)	C.S.
	18	1	FP19696	PIPE NIPPLE, 1/2 X 3/8 FF	C.S.
	19	1	FP10506	STREET ELBOW, 3/8NPT	C.S.
	20	1	FP10580	STREET ELBOW, 1/2NPT	C.S.
	21	2	FP01800	HOSE FTG, 3/8 X 3/8NPT	BRS
	22	4'	AG70033	PUSH LOK LP HOSE, #801 (MIN 200 PSI)	RUB
	23	1	AG03318	SHUTTLE VALVE (#SV-4)	BRS
	24	2	FP31260	MALE ELBOW, 3/8 X 3/8NPT	BRS
	25	2	FP31070	MALE CONN, 3/8 X 3/8NPT	BRS
	26	2	AG74671	TUBING, 3/8 X 7"	CPR
	27	4	FQ02049	1/2-13 X 2 1/4 LG HHCS, TEFL	GR5
	28	4	FQ12257	1/2-13 HX NUT, TEFL	GR5
	29	4	FQ11202	1/2 LWSHR, TEFL	C.S.
	30	4	FQ12735	1/2 FWSHR, TEFL	C.S.
402513	31	1	AG02513	CYLINDER GUARD	C.S.
	32	1	AG04537	ROD CLEVIS	C.S.
	33	1	AG05316	1/2 NPT DUST EXCLUDERS	S.S.
	34	4	FQ10511	3/4 USS FWSHR, PLT'D	C.S.
402757	35	1	AG02757	STOP TUBE,CORED BRZ BC-920 CUT TO 5L	C.S.

TOT. WT = 137#

APPROVED FOR CONSTRUCTION

APP'D BY _____ DATE _____ REV. _____

TOLERANCE UNLESS OTHERWISE SPECIFIED		PAINT SPEC.	DO NOT SCALE
.XX ± .015	ANGLES ± 1/2°	MATERIAL	DRAWN BY JNN
.XXX ± .005	125 ALL MACHINED SURFACES		CHECKED / DATE
FRACTION ± 1/16		UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES REMOVE ALL SHARP CORNERS WITH .030 MAX.	APPROVED / DATE

RAM WINCH HOIST
P.O. BOX 62063
HOUSTON, TEXAS 77205

CUSTOMER P.O. NO.:

PROJECT:

DRAWING TITLE: ø33 1/2" AUTO-BRAKE ASSEMBLY (NEW DESIGN)

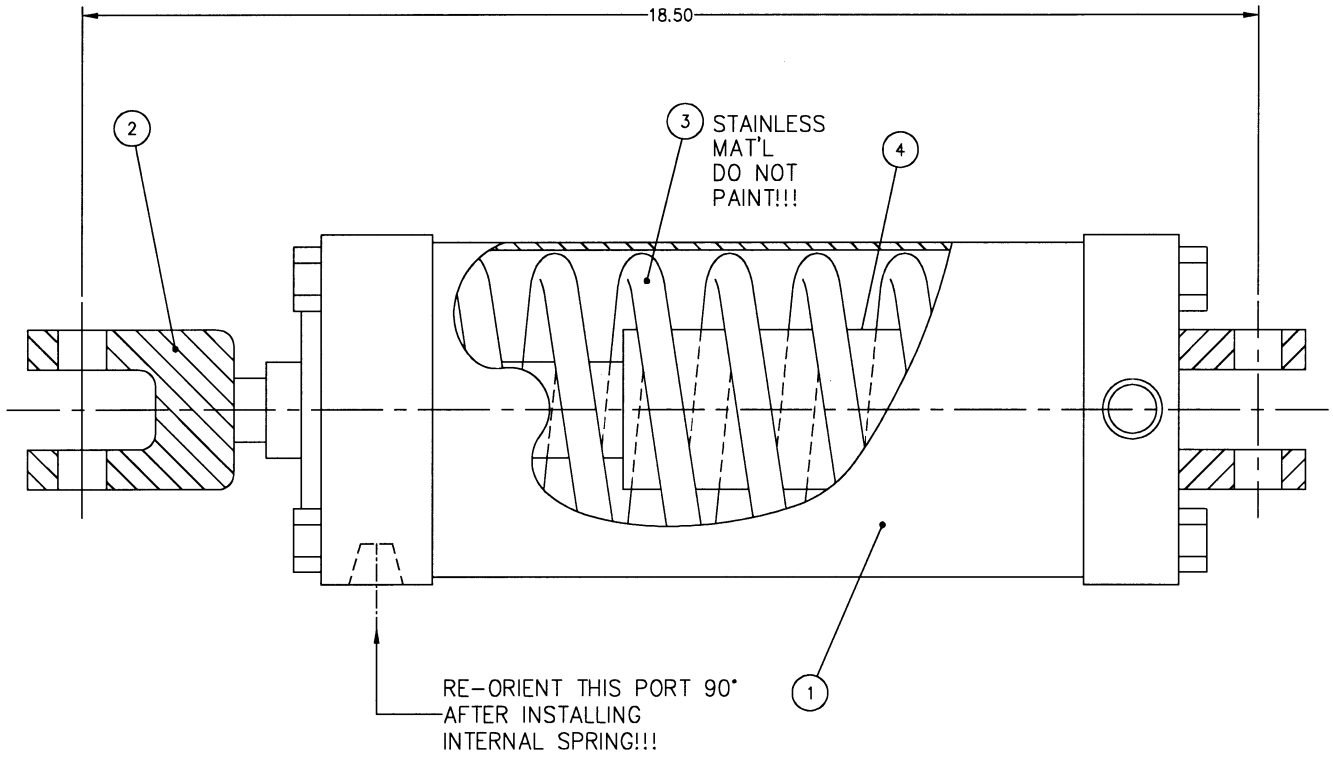
MODEL: AW2.5B/2.8B/2.9/3.0B

JOB NO.: DRAWING NUMBER: REV.: 0 DATE: 1/6/

REVISIONS		
REV. NO.	DESCRIPTION	DATE / ECN NO.

DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L
	1	1	AG04541	MILLER AIR CYLINDER , 5" BORE	CS
	2	1	AG04537	MILLER AIR CYLINDER ROD END CLEVIS	CS
401952	3	1	AG01952	CYLINDER COMPRESSION SPRING ø4.9 x 16 LG	SS
	4	1	AG02757	STOP TUBE, CORED BRONZE BC920 CUT TO 6L	BRZ

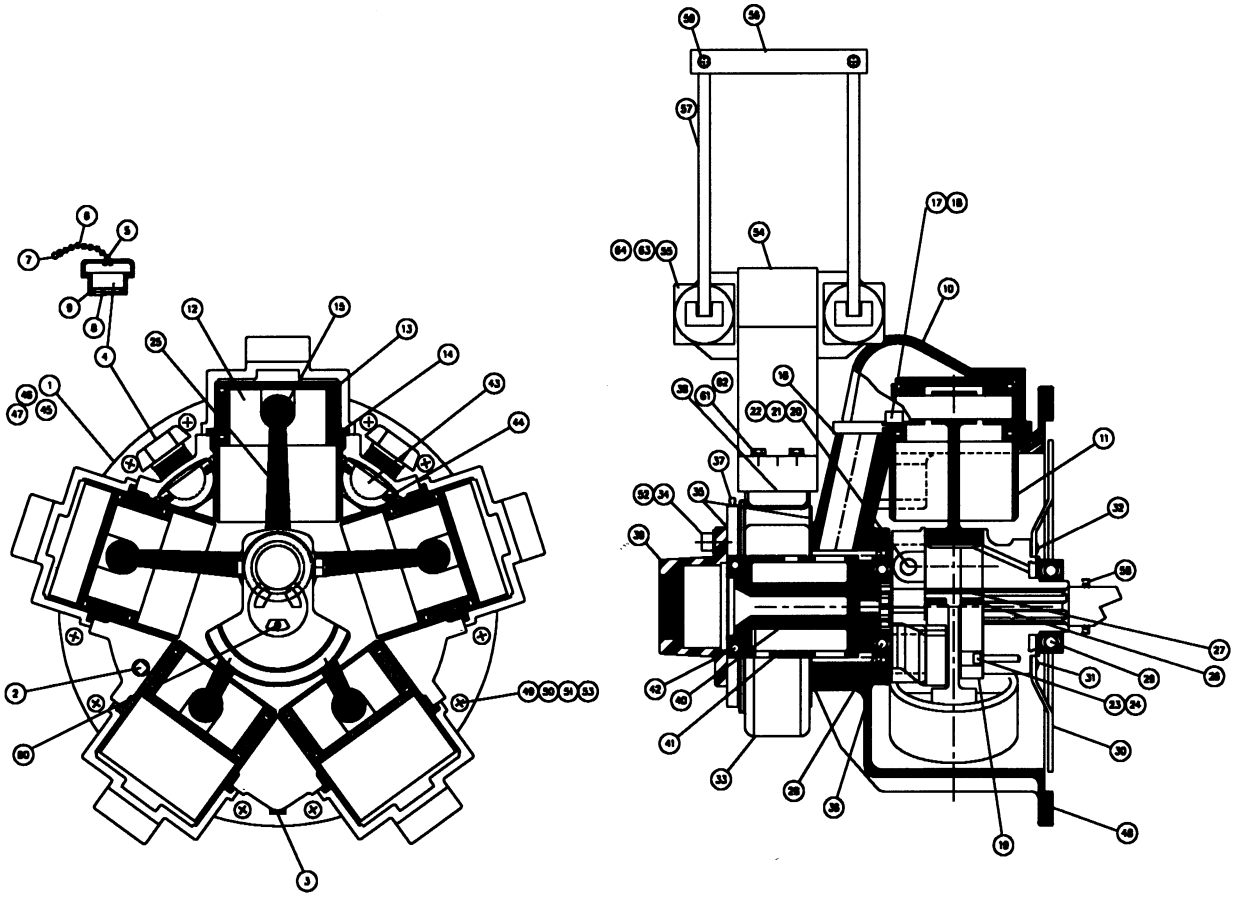
WT=45#



TOLERANCE UNLESS OTHERWISE SPECIFIED		PAINT SPEC.	DO NOT SCALE
X ± .015	ANGLES ± 1/2°	MATERIAL	DRAWN BY: JNN
XX ± .005	125/ ON ALL MACHINED SURFACES		CHECKED / DATE
FRACTION ± 1/16		UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES REMOVE ALL SHARP CORNERS WITH .03R MAX.	APPROVED / DATE

RAM WINCH HOIST
P.O. BOX 62063
HOUSTON, TEXAS 77205

CUSTOMER: RAM ITC.	DRAWING TITLE: 5"DIA. BORE X 9" STROKE BRAKE CYLINDER(AIR) ASSY.		
CUSTOMER P.O. NO.:	MODEL: AW2.5/AW/2.8/AW2.9/AW3/AW4/AW4/WF/ACW P/N AG02524		
PROJECT:	JOB NO.:	DRAWING NUMBER: 402524	REV.: 2 / DATE: 11/22/9
		SIZE: B	SCALE: 6"=1'-0



Model PD5
Pentadome Air Motor
P/N AF50000

RAM WINCH HOIST
P.O. BOX 62063

CUSTOMER:	DRAWING TITLE: PENTADOME AIR MOTOR ASSY.
CUSTOMER P.O. NO.:	MODEL: MODEL PD5 P/N AF50000

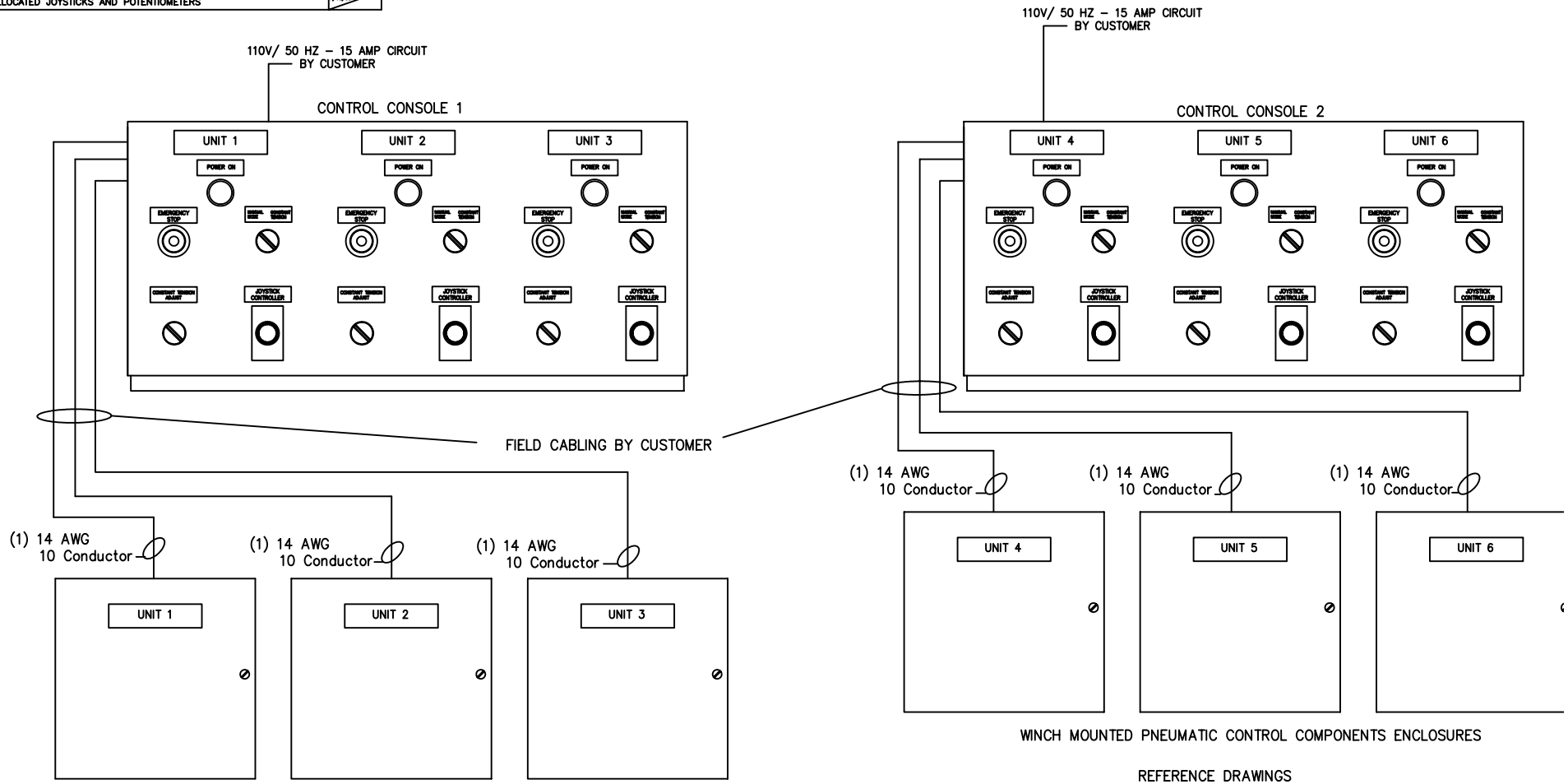
Model PD5
PENTADOME AIR MOTOR AF50000
PARTS LIST

No.	Part No.	Qty	Description
1	PD5-501	1	Motor Case
2	PD5-402	1	Oil Chamber Plug
3	PD5-29	1	Plug
4	PD5-303A	2	Vent Cap
5	PD5-893	1	Vent Cap Cotter
6	PD5-891	1	Vent Cap Chain
7	PD5-421	1	"S" Hook
8	PD5-889	1	Vent Cap Screen
9	PD5-233-1/2	1	Vent Cap Retainer
10	PD5-H505A	5	Cylinder Head
11	PD5-L505A	5	Cylinder Sleeve
12	PD5-A513A	5	Piston
13	PD5-337-5	1	Piston Ring Set
14	PD5-338-5	1	Oil Regulating Ring Set
15	PD5-514	5	Wrist Pin
16	PD5-507	5	Cylinder Gasket
17	PD5-13	20	Cylinder Cap Screw
18	PD5-504	20	Cylinder Washer
19	PD5-516	1	Crank Assembly
20	PD5-520	1	Pin
21	PD5-317	1	Nut
22	PD5-330	1	Cotter
23	FQ00837	3	Cap Screw
24	FQ11107	3	Lock Washer
25	PD5-509	5	Connecting Rod
26	PD5-510	2	Connecting Rod Ring
27	PD5-511	1	Connecting Rod Bushing
28	PD5-518	1	Valve End Crank Bearing
29	PD5-518PE	1	Pin End Crank Bearing
30	PD5-540	1	Splasher
31	PD5-541	2	Long Rivet
32	PD5-542	2	Short Rivet

No.	Part No.	Qty	Description
33	PD5-545	1	Rotary Valve Housing
34	PD5-51471	5	Cap Screw
35	PD5-928	2	Gasket
36	PD5-248	1	O-Ring
37	PD5-188	1	Grease Fitting
38	PD5-547	1	Gasket
39	PD5-413	1	Exhaust Cover
40	PD5-526	1	Rotary Valve
41	PD5-607A	4	Seal Ring
42	PD5-97	1	Bearing
43	PD5-528	2	Oil Baffle
44	FQ00005	4	Baffle Screw
45	PD5-888	2	Eyebolt (Optional)
46	PD5-99	1	Motor Nameplate
47	PD5-302	4	Nameplate Drive Scre
48	PD5-592	1	Motor Gasket
49	PD5-36	10	Cap Screw
50	PD5-67	10	Washer
51	PD5-776	10	Nut
52	PD5-322	5	Washer
53	FQ10400	10	Washer
54	PD5-740	1	Manifold
55	PD5-V556	2	Control Valve
56	PD5-V556TR	1	Control Valve Tie Ro
57	PD5-L556	2	Control Lever
58	PD5-913	1	Oil Seal
59	AG20020	4	Set Screw
60	PD5-60	1	Pin
61	FQ00812	4	5/16–18 x 2 ¼ lg HH
62	FQ11055	4	5/16 Lock Washer
63	FQ00887	6	3/8 – 24 x 1" lg HHC
64	FQ11105	6	3/8 Lock Washer

REVISIONS		
DESCRIPTION	DATE	ECN NO.
RELOCATED JOYSTICKS AND POTENTIOMETERS	7/18/08	

DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L



WINCH MOUNTED PNEUMATIC CONTROL COMPONENTS ENCLOSURES

WINCH MOUNTED PNEUMATIC CONTROL COMPONENTS ENCLOSURES

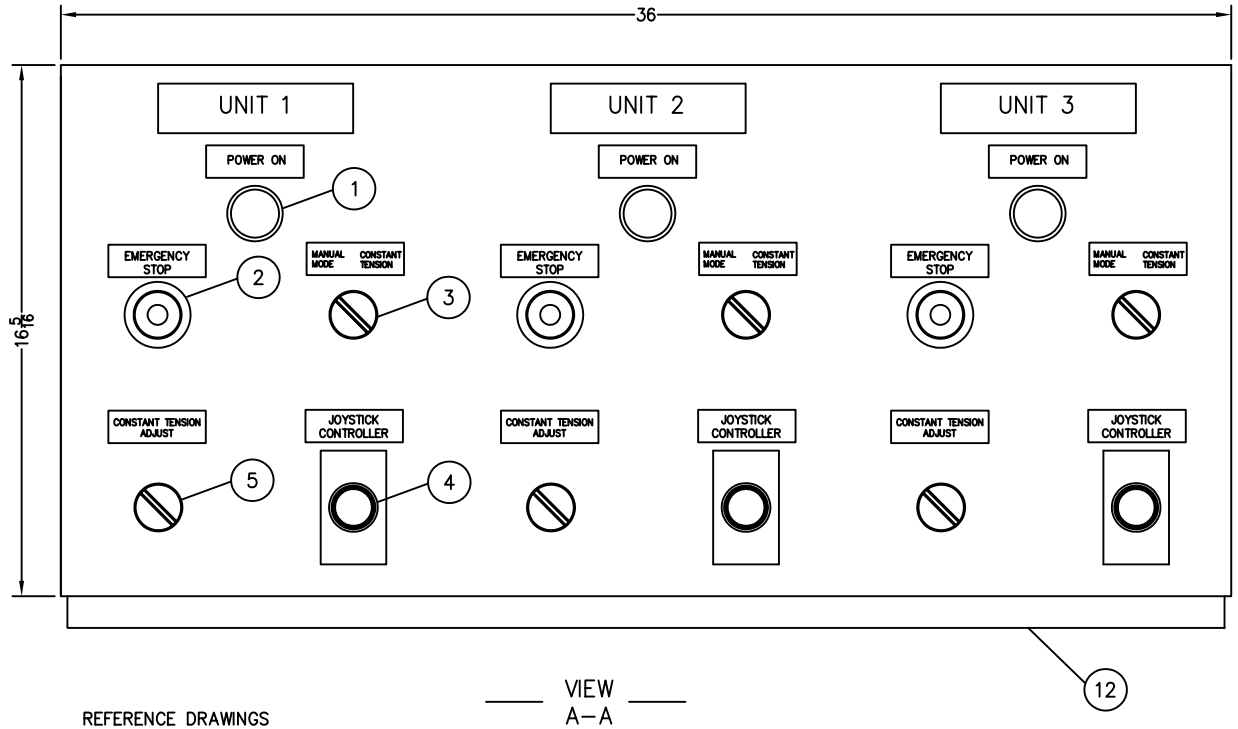
REFERENCE DRAWINGS

405626 – WINCH PNEUMATIC CONTROL COMPONENTS
405624 – CONTROL CONSOLE 1
405625 – CONTROL CONSOLE 2
405627 – ELECTRICAL SCHEMATIC
405628 – PNEUMATIC CONTROLS SCHEMATIC
405629 – WINCH PNEUMATIC SCHEMATIC
405630 – POWER DISTRIBUTION

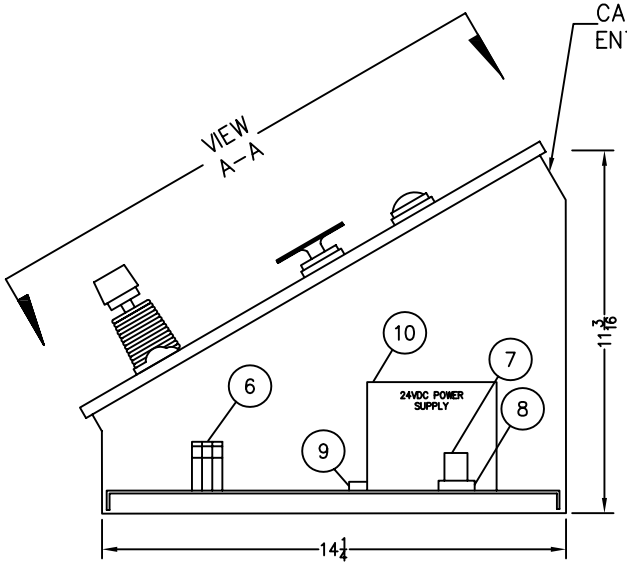
OLERANCE SS OTHERWISE SPECIFIED	PAINT SPEC.	DO NOT SCALE	This drawing is the property of RAM ITC. The design and data shown includes proprietary information that describes RAM ITC products. The borrower by receipt and retention of the drawing agrees that except as expressly authorized in writing by RAM ITC., it will (1) only use the drawing or the design and data shown for the the purpose intended by RAM ITC; (2) not loan,	RAM WINCH HOIST	CUSTOMER:	DRAWING TITLE: WINCH REMOTE CONTROL SYSTEM INTERCONNECT
.15 ANGLES ± 1/2°	MATERIAL	DRAWN BY CTC			CUSTOMER P.O. NO.:	MODEL: REMOTE CONTROL SYSTEM W/ CONSTANT TENSIONING
		CHECKED / DATE		P.O. BOX 62063		

REVISIONS	
DESCRIPTION	DATE / ECN NO.
RELOCATED JOYSTICKS AND POTENTIOMETERS	7/18/08

DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L
	1	3	FS06000	POWER ON LIGHT	
	2	3	FS06001	EMERGENCY STOP PUSH-PULL SWITCH	
	3	3	FS06002	MODE SELECTOR SWITCH	
	4	3	AG35306	JOYSTICK CONTROLLER	
	5	3	AG35362	CONSTANT TENSION ADJUST POT	
	6	30	FS06004	TERMINAL BLOCKS	
	7	3	AG35357	RELAY	
	8	3	AG35359	RELAY SOCKET	
	9	2	FW06001	FUSEHOLDER	
	10		FW06005	POWER SUPPLY - 24VDC	
S001563-64	11	1	-	NAMEPLATES	
	12	1	FS06003	CONSOLE 1 ENCLOSURE	



VIEW A-A



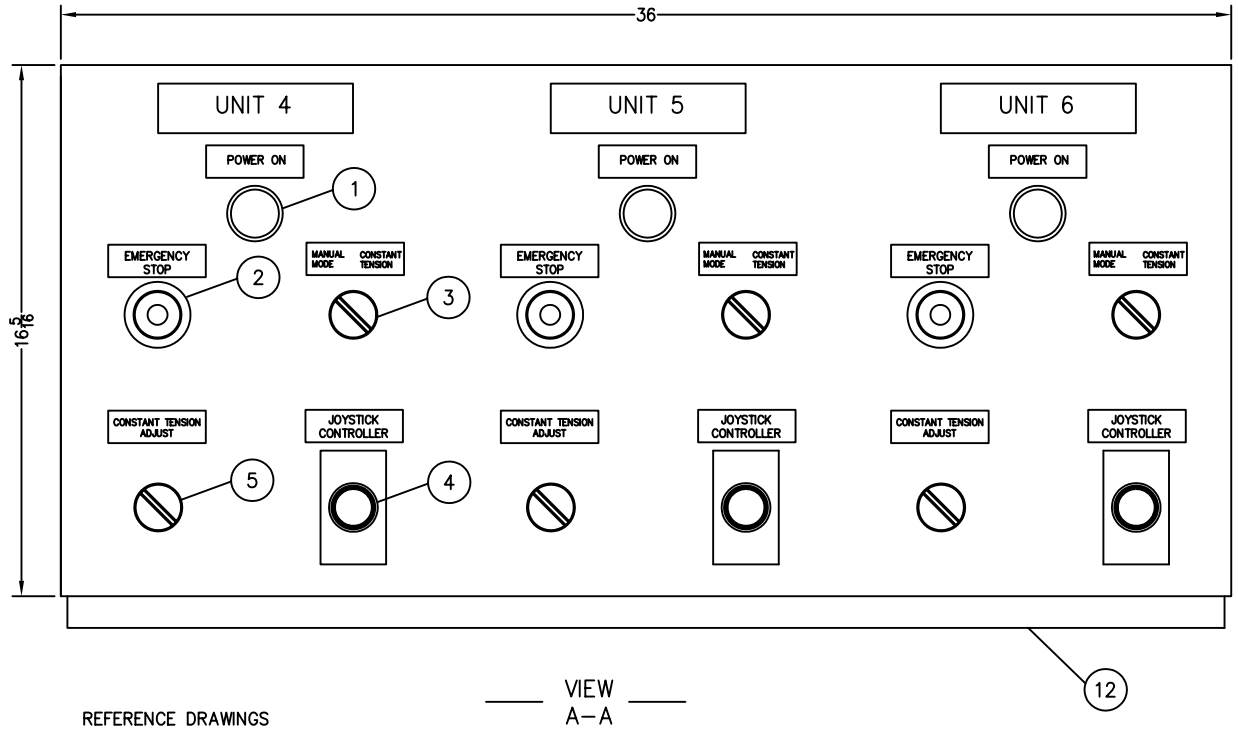
REFERENCE DRAWINGS

05629 - WINCH PNEUMATIC CONTROL COMPONENTS
05623 - SYSTEM INTERCONNECT DRAWING
05625 - CONTROL CONSOLE 2
05627 - ELECTRICAL SCHEMATIC
05628 - PNEUMATIC CONTROLS SCHEMATIC
05629 - WINCH PNEUMATIC SCHEMATIC
05630 - POWER DISTRIBUTION

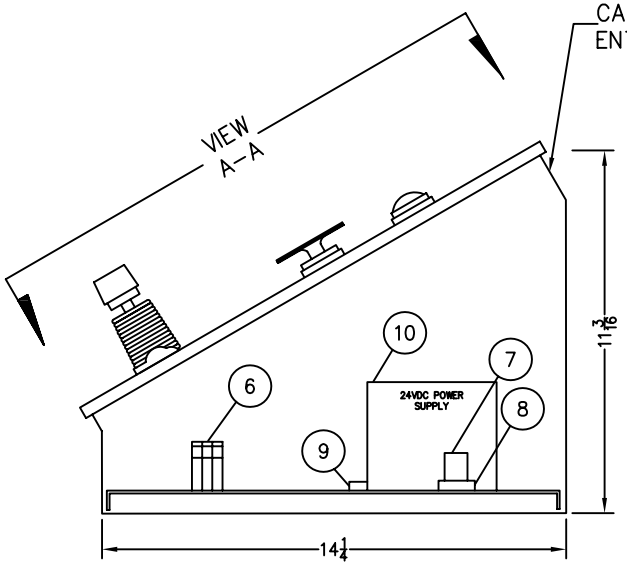
OLERANCE SS OTHERWISE SPECIFIED	PAINT SPEC.	DO NOT SCALE	This drawing is the property of RAM ITC. The design and data shown includes proprietary information that describes RAM ITC products. The borrower by receipt and retention of the drawing agrees that except as expressly authorized in writing by RAM ITC., it will (1) only use the drawing or the design and data shown for the the purpose intended by RAM ITC; (2) not loan,	RAM WINCH HOIST P.O. BOX 62963	CUSTOMER:	DRAWING TITLE: CONTROL CONSOLE 1
ANGLES ± 1/2°	MATERIAL	DRAWN BY CTC			CUSTOMER P.O. NO.:	MODEL: REMOTE CONTROL SYSTEM W/ CONSTANT TENSIONING
		CHECKED / DATE				

REVISIONS	
DESCRIPTION	DATE / ECN NO.
RELOCATED JOYSTICKS AND POTENTIOMETERS	7/18/08

DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L
	1	3	FS06000	POWER ON LIGHT	
	2	3	FS06001	EMERGENCY STOP PUSH-PULL SWITCH	
	3	3	FS06002	MODE SELECTOR SWITCH	
	4	3	AG35306	JOYSTICK CONTROLLER	
	5	3	AG35362	CONSTANT TENSION ADJUST POT	
	6	30	FS06004	TERMINAL BLOCKS	
	7	3	AG35357	RELAY	
	8	3	AG35359	RELAY SOCKET	
	9	2	FW06001	FUSEHOLDER	
	10		FW06005	POWER SUPPLY - 24VDC	
S001563-64	11	1	-	NAMEPLATES	
	12	1	FS06003	CONSOLE 2 ENCLOSURE	



VIEW A-A



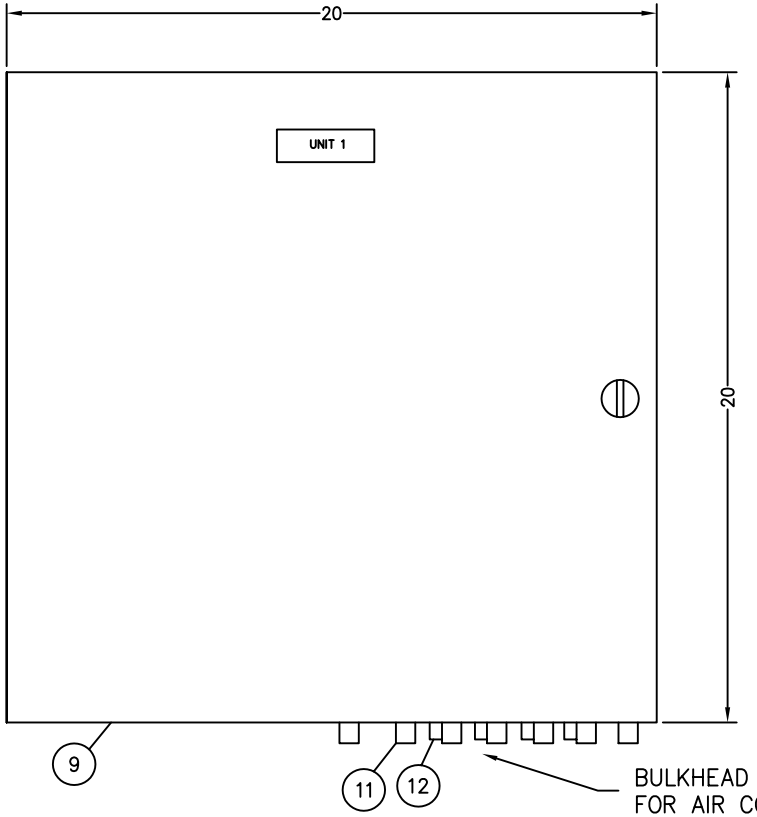
REFERENCE DRAWINGS

05629 - WINCH PNEUMATIC CONTROL COMPONENTS
05623 - SYSTEM INTERCONNECT DRAWING
05624 - CONTROL CONSOLE 1
05627 - ELECTRICAL SCHEMATIC
05628 - PNEUMATIC CONTROLS SCHEMATIC
05629 - WINCH PNEUMATIC SCHEMATIC
05630 - POWER DISTRIBUTION

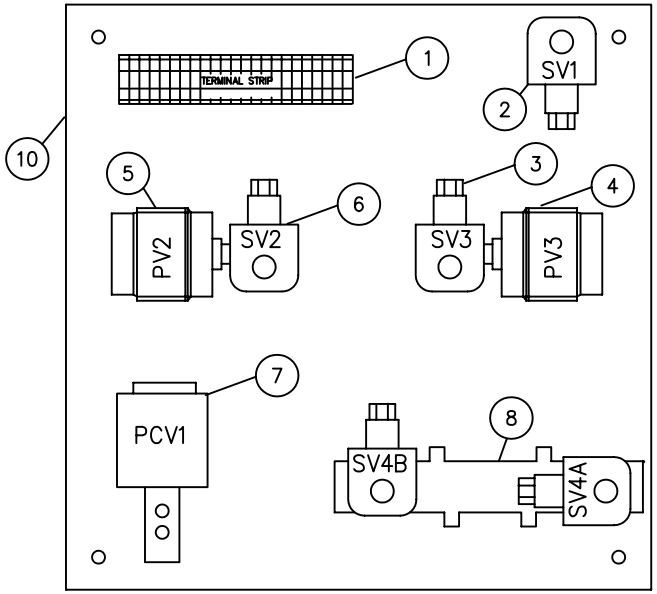
OLERANCE SS OTHERWISE SPECIFIED	PAINT SPEC.	DO NOT SCALE	This drawing is the property of RAM ITC. The design and data shown includes proprietary information that describes RAM ITC products. The borrower by receipt and retention of the drawing agrees that except as expressly authorized in writing by RAM ITC., it will (1) only use the drawing or the design and data shown for the the purpose intended by RAM ITC; (2) not loan,	RAM WINCH HOIST P.O. BOX 62963	CUSTOMER:	DRAWING TITLE: CONTROL CONSOLE 2
ANGLES ± 1/2°	MATERIAL	DRAWN BY CTC			CUSTOMER P.O. NO.:	MODEL: REMOTE CONTROL SYSTEM W/ CONSTANT TENSIONING
		CHECKED / DATE				

REVISIONS		
DESCRIPTION	DATE	BSN NO.

DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L
	1	1	FS06004	TERMINAL STRIP	
	2	1	AG35318	SV1	
	3	1	AG35318	SV3	
	4	1	AG35317	PV3	
	5	1	AG35316	PV2	
	6	1	AG35318	SV2	
	7	1	AG35257	PCV1	
	8	1	AG35468	SV4	
	9	1	FV06000	PNEUMATIC CONTROLS ENCLOSURE	
	10	1	FV06001	PNEUMATIC CONTROLS ENCL SUB-PANEL	
	11	3	FP50112	1/4"NPT X 1/4"NPT BULKHEAD CONNECTOR	
	12	8	FP50113	1/4" FML NPT X 1/4" TUBE BULKHEAD	



LOCAL WINCH MOUNTED PNEUMATIC
CONTROLS COMPONENTS ENCLOSURE
20 X 20 X 8 NEMA 4X STAINLESS STEEL



TYPICAL OF UNITS 1 THRU 6

REFERENCE DRAWINGS

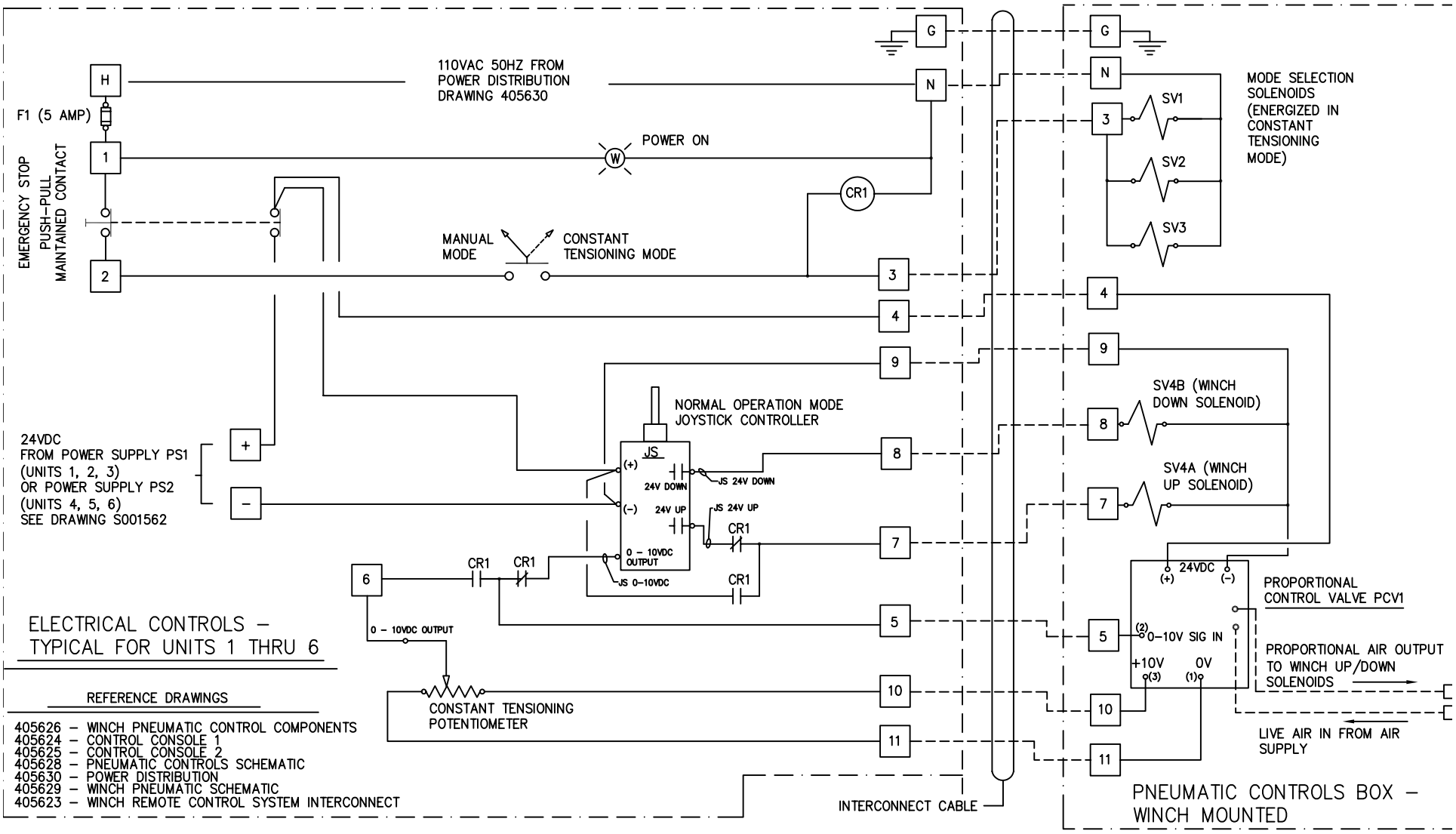
405623 – SYSTEM INTERCONNECT DRAWING
405624 – CONTROL CONSOLE 1
405625 – CONTROL CONSOLE 2
405627 – ELECTRICAL SCHEMATIC
405628 – PNEUMATIC CONTROLS SCHEMATIC
405629 – WINCH PNEUMATIC SCHEMATIC
405630 – POWER DISTRIBUTION

TOLERANCE UNLESS OTHERWISE SPECIFIED	PAINT SPEC.	DO NOT SCALE
ANGLES ±15 ± 1/2°	MATERIAL	DRAWN BY CTC
		CHECKED / DATE

RAM WINCH HOIST
P.O. BOX 62963

CUSTOMER:	DRAWING TITLE: WINCH PNEUMATIC CONTROL COMPONENTS
CUSTOMER P.O. NO.:	MODEL: REMOTE CONTROL SYSTEM W/ CONSTANT TENSIONING

1	2	3	4	5				6
REVISIONS				DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L
DESCRIPTION	DATE / ECN NO.							



ELECTRICAL CONTROLS – TYPICAL FOR UNITS 1 THRU 6

REFERENCE DRAWINGS

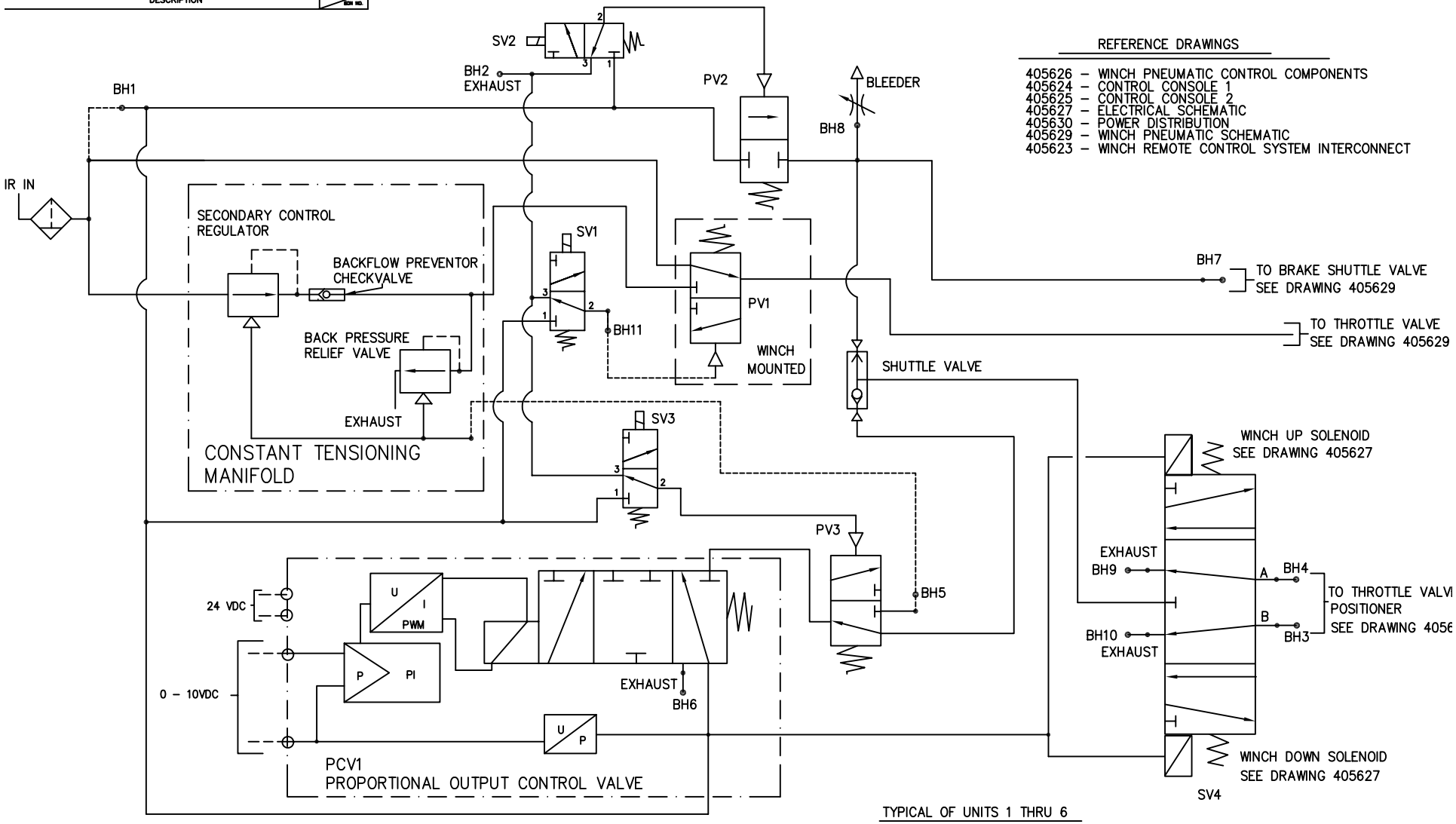
405626 – WINCH PNEUMATIC CONTROL COMPONENTS
405624 – CONTROL CONSOLE 1
405625 – CONTROL CONSOLE 2
405628 – PNEUMATIC CONTROLS SCHEMATIC
405630 – POWER DISTRIBUTION
405629 – WINCH PNEUMATIC SCHEMATIC
405623 – WINCH REMOTE CONTROL SYSTEM INTERCONNECT

TOLERANCE UNLESS OTHERWISE SPECIFIED	PAINT SPEC.	DO NOT SCALE		CUSTOMER:	DRAWING TITLE: ELECTRICAL SCHEMATIC
.15 ANGLES ± 1/2°	MATERIAL	DRAWN BY CTC		CUSTOMER P.O. NO.:	MODEL: REMOTE CONTROL SYSTEM W/ CONSTANT TENSIONING
		CHECKED / DATE	RAM WINCH HOIST P.O. BOX 62068		

1	2	3	4	5	6

REVISIONS		
DESCRIPTION	DATE	ECN NO.

DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L



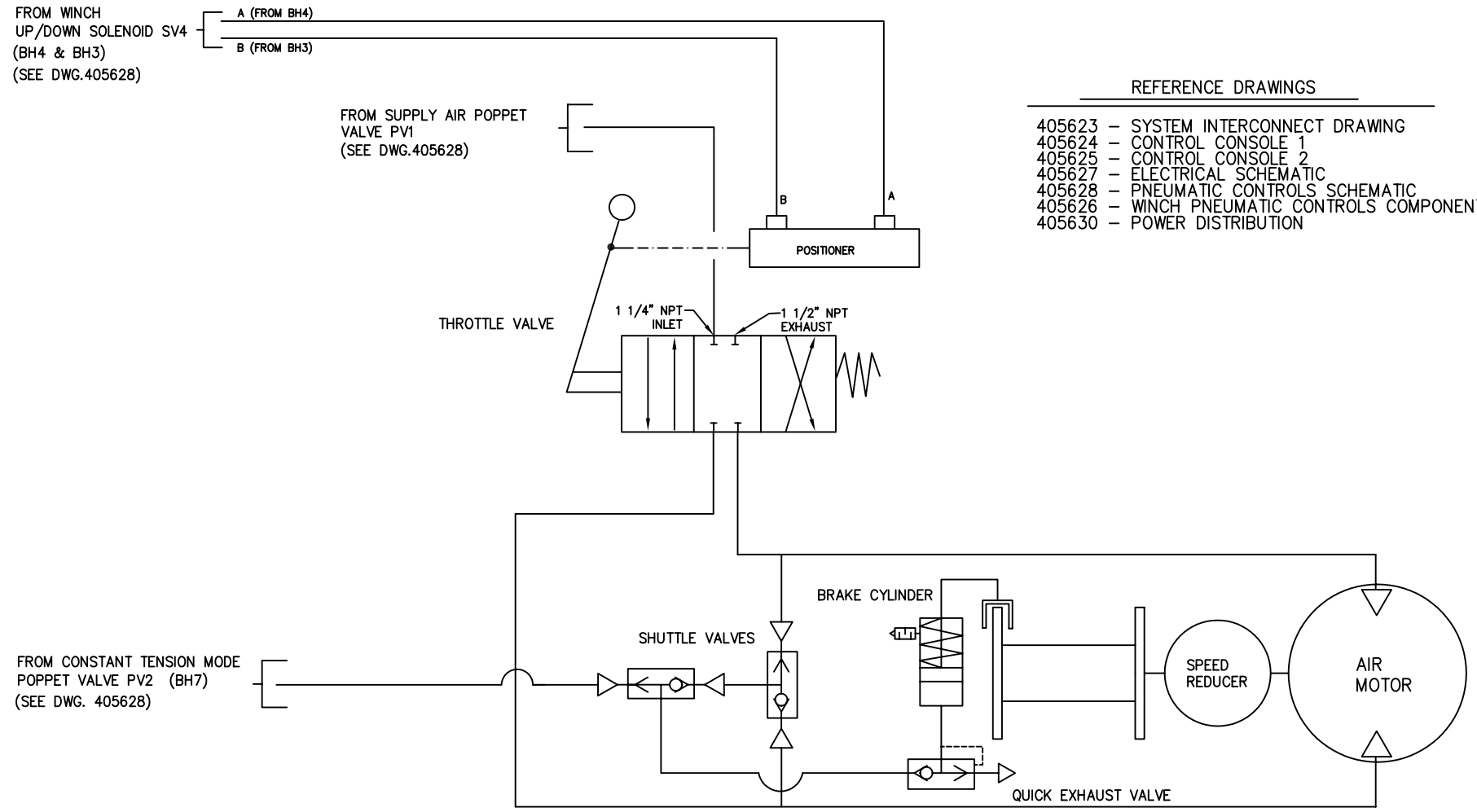
REFERENCE DRAWINGS

405626 – WINCH PNEUMATIC CONTROL COMPONENTS
405624 – CONTROL CONSOLE 1
405625 – CONTROL CONSOLE 2
405627 – ELECTRICAL SCHEMATIC
405630 – POWER DISTRIBUTION
405629 – WINCH PNEUMATIC SCHEMATIC
405623 – WINCH REMOTE CONTROL SYSTEM INTERCONNECT

TYPICAL OF UNITS 1 THRU 6

OLERANCE SS OTHERWISE SPECIFIED	PAINT SPEC.	DO NOT SCALE	This drawing is the property of RAM ITC. The design and data shown includes proprietary information that describes RAM ITC products. The borrower by receipt and retention of the drawing agrees that except as expressly authorized in writing by RAM ITC., it will (1) only use the drawing or the design and data shown for the the purpose intended by RAM ITC; (2) not loan,	RAM WINCH HOIST	CUSTOMER:	DRAWING TITLE: PNEUMATIC CONTROLS SCHEMATIC
15 ANGLES ± 1/2°	MATERIAL	DRAWN BY CTC			CUSTOMER P.O. NO.:	MODEL: REMOTE CONTROL SYSTEM W/ CONSTANT TENSIONING
		CHECKED / DATE				

1	2	3	4	5					6
REVISIONS				DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L
DESCRIPTION	DATE / ECN NO.								



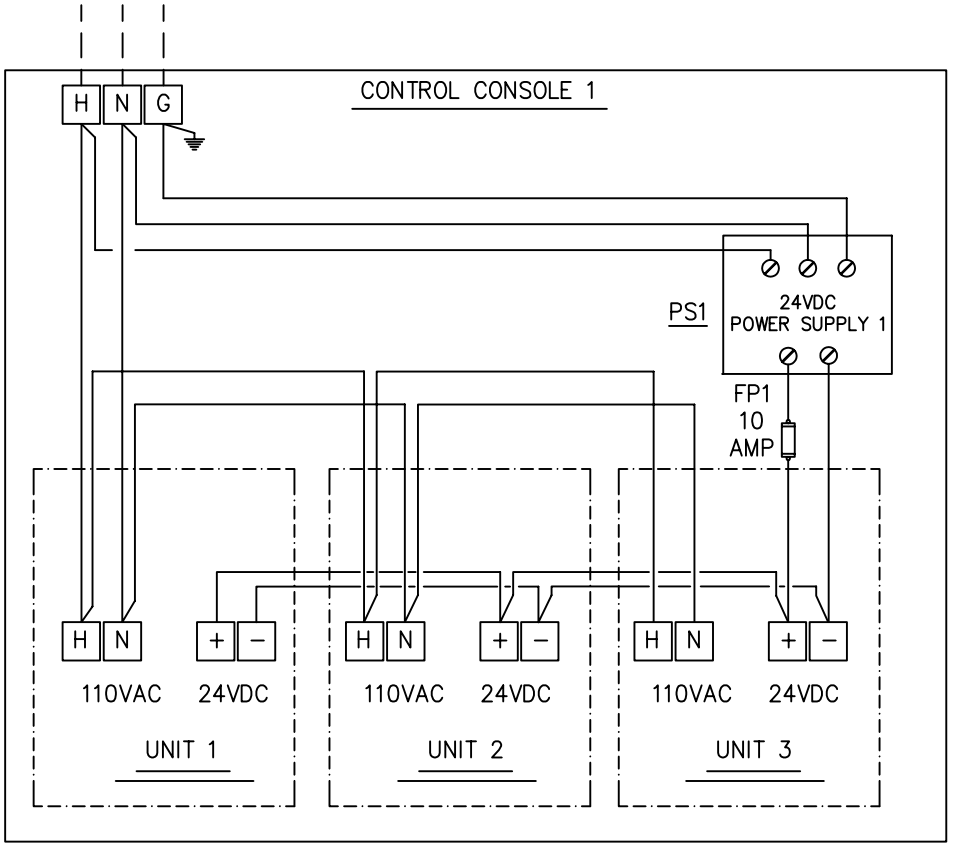
REFERENCE DRAWINGS

405623 – SYSTEM INTERCONNECT DRAWING
405624 – CONTROL CONSOLE 1
405625 – CONTROL CONSOLE 2
405627 – ELECTRICAL SCHEMATIC
405628 – PNEUMATIC CONTROLS SCHEMATIC
405626 – WINCH PNEUMATIC CONTROLS COMPONENTS
405630 – POWER DISTRIBUTION

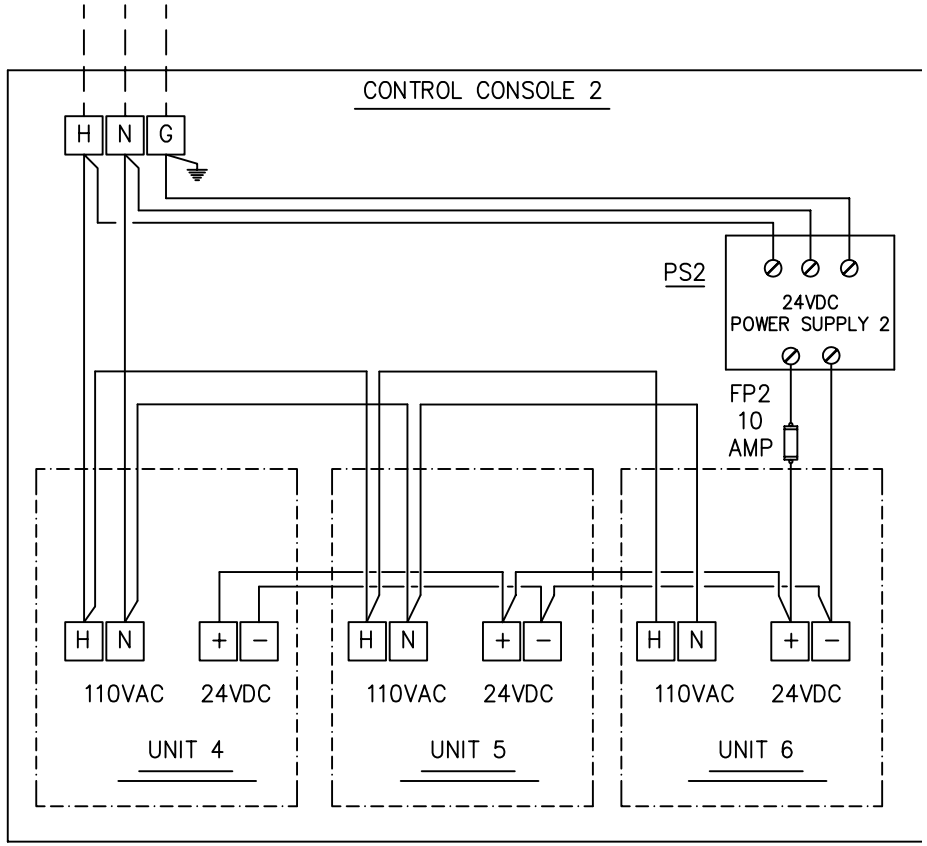
OLERANCE SS OTHERWISE SPECIFIED	PAINT SPEC.	DO NOT SCALE	This drawing is the property of RAM ITC. The design and data shown includes proprietary information that describes RAM ITC products. The borrower by receipt and retention of the drawing agrees that except as expressly authorized in writing by RAM ITC., it will (1) only use the drawing or the design and data shown for the the purpose intended by RAM ITC; (2) not loan,	RAM WINCH HOIST	CUSTOMER:	DRAWING TITLE: WINCH PNEUMATIC SCHEMATIC
15 ANGLES ± 1/2°	MATERIAL	DRAWN BY CTC			CUSTOMER P.O. NO.:	MODEL: REMOTE CONTROL SYSTEM W/ CONSTANT TENSIONING
		CHECKED / DATE				

1	2	3	4	5				6	
REVISIONS				DWG NO.	ITEM	QTY	PART NO.	DESCRIPTION	MAT'L
DESCRIPTION	DATE / ECN NO.								

110V/50HZ 15AMP CIRCUIT 1 BY CUSTOMER



110V/50HZ 15AMP CIRCUIT 2 BY CUSTOMER



REFERENCE DRAWINGS

405626 – WINCH PNEUMATIC CONTROL COMPONENTS
405624 – CONTROL CONSOLE 1
405625 – CONTROL CONSOLE 2
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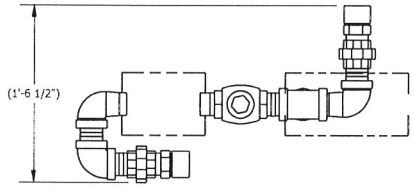
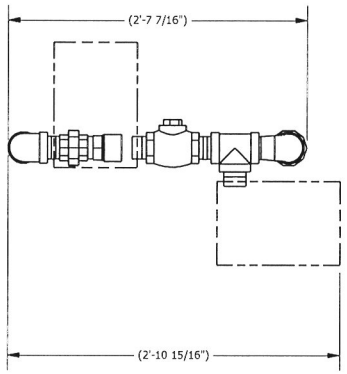
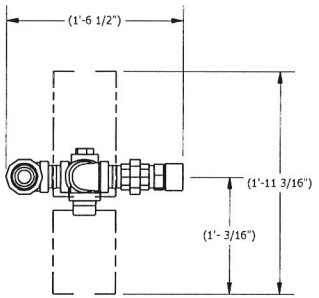
405628 – PNEUMATIC CONTROLS SCHEMATIC
405629 – WINCH PNEUMATIC SCHEMATIC
405623 – WINCH REMOTE CONTROL SYSTEM INTERCONNECT

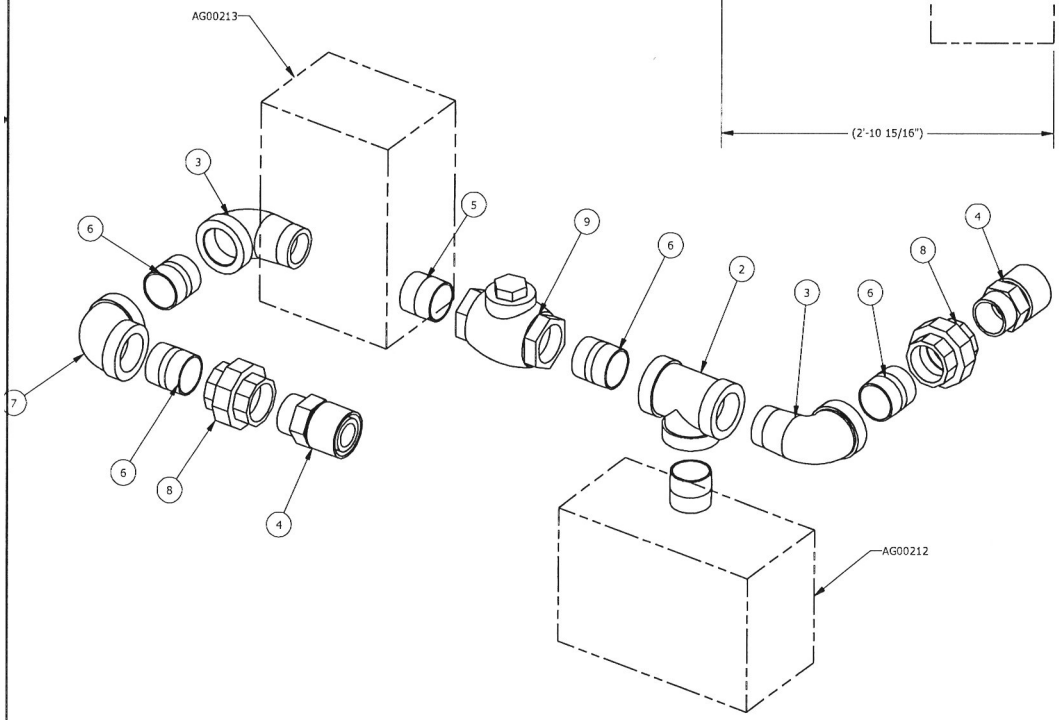
OLERANCE SS OTHERWISE SPECIFIED	PAINT SPEC.	DO NOT SCALE	This drawing is the property of RAM ITC. The design and data shown includes proprietary information that describes RAM ITC products. The borrower by receipt and retention of the drawing agrees that except as expressly authorized in writing by RAM ITC., it will (1) only use the drawing or the design and data shown for the the purpose intended by RAM ITC; (2) not loan,	RAM WINCH HOIST	CUSTOMER:	DRAWING TITLE: POWER DISTRIBUTION
15 ANGLES ± 1/2°	MATERIAL	DRAWN BY CTC			CUSTOMER P.O. NO.:	MODEL: REMOTE CONTROL SYSTEM W/ CONSTANT TENSIONING
		CHECKED / DATE				

REV	DESCRIPTION	DATE	E
0	INITIAL RELEASE	12/15/2007	









ITEM	DRAW NO.	PART NO.	QTY	DESCRIPTION	EXPANDED DESCRIP	WT (L
11		AG00213	1	2" REGULATOR, PRESS REDUCER		0
10		AG00212	1	2" REGULATOR, BACK PRESSURE		0
9			1	2" CHECK VALVE		4.5
8			2	2" Union		2.5
7			1	2" 90 DEG ELBOW		3.5
6			4	2" BARREL NIPPLE		1.0
5			2	2" CLOSE NIPPLE		.46
4			2	2" HOSE BARB		5.8
3			2	2" 90 Deg Street Elbow		6.8
2			1	2" Tee		4.9
1			AR	2" HOSE ASSEMBLY		

Parts List

EST. FINISHED WT. LBS

ACTUAL WT. LBS

ORIGINAL JOB NO: RS7061

AW3BKD5

NEXT ASSEMBLY

MODEL NO.

3rd ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS ARE IN INCHES
AND ALL TOLERANCES ARE AS STATED

ANGLES: ±0.5°

SURFACE FINISH: 125 ON ALL MACHINED SURFACES

DIMENSIONS:
X.X ±0.06
X.XX ±0.015
X.XXX ±0.005
FRACTION ±1/16

SURFACE FEATURES: MACHINED PARTS ONLY

T.I.R .005 PERPENDICULAR ⊥ .015

FLATNESS ⏥ 0.010 PARALLEL // .015

BREAK ALL SHARP EDGES

DWN:	W. CULBERTSON	12/14/2007
CKD:	M. WEHMEYER	12/15/07
ENG:	J. NAVARRO	12/15/07
APVD:	J. NAVARRO	12/15/07

RAM WINCH HOIST

14603 CHRISMAN
HOUSTON, TX 77039

TITLE: CONSTANT TENSIONING ASSY

SIZE: B DWG NUMBER: 405442 REV: 0

PT/NO:

SCALE: NTS

SH: 1 O

System Description

The RAM Constant Tensioning Remote Control System consists of remote mounted Control Console(s) housing electrical controls for the winches. The electrical controls control the operation of the pneumatic solenoids and control valves in the separate Pneumatic Controls enclosure(s) mounted on the winches. The operational controls on multi-unit Control Consoles are grouped by unit number and operate multiple winches individually.

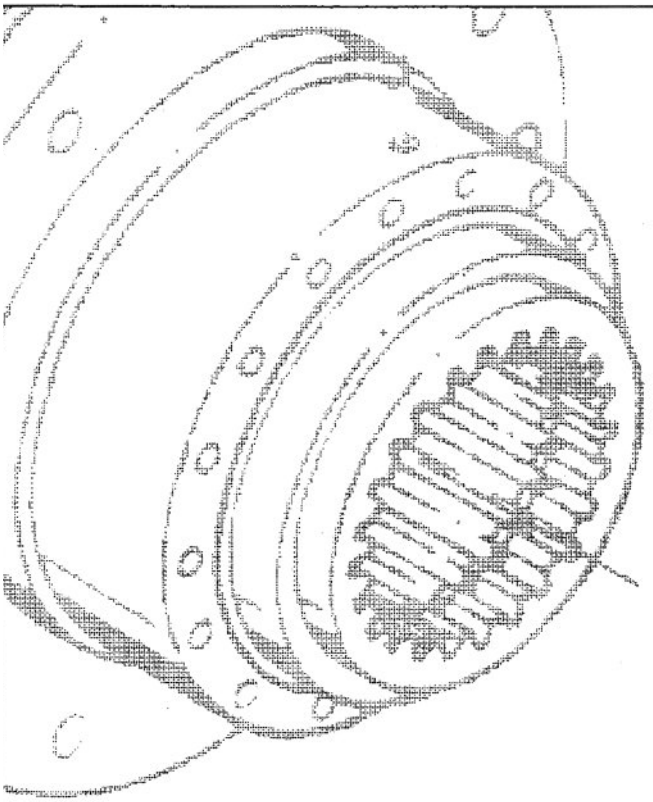
Operational Description

The controls for each winch unit provide options for Manual (joystick) Control or Constant Tensioning Control in the “Inhaul” direction of operation. In the Manual Control mode, the Inhaul speed is controlled by the joystick.

In the Constant Tensioning mode, the Inhaul speed or tension range is dictated by the manual adjustments of the Secondary Control Regulator and the Back Pressure Relief Regulator, and precisely controlled by the pilot air pressure to the two regulators. The pilot air to the regulators is metered by the output of the Proportional Output valve (PCV1) which in turn is controlled by the setting of the Constant Tension adjustment potentiometer.

! WARNING !

Switching from Manual Mode to the Constant Tension mode will immediately fully *release* the winch brake, and switching from Constant Tension to Manual will immediately *set* the winch brake. It is therefore important to position the Constant Tension adjustment potentiometer to a previously proven safe position to assure stability when switching from one mode to the other under load.



RAM P/N AH00315

GEAR REDUCER

Assembly-Disassembly Manual

Table of Contents

Introduction

Users of this manual should note that each part mentioned is followed by an identification number enclosed in parentheses. These part numbers may be referred to in the Parts List section of this manual and on the illustrated parts breakdown of this unit.

Any specialized tools normally used to assemble this unit are noted in the assembly procedures and diagrammed in the tooling section.

Users should familiarize themselves with the procedures for roll and leak testing and bolt tightening and torquing found on the following two pages before getting started.

Safety

Standard safety practices should be followed during the disassembly and assembly procedures described. Safety glasses and safety shoes should be worn. Heavy, heat resistant gloves should be used when heated components are handled. Be especially alert when you see the word **CAUTION**. This indicates that a particular operation could cause personal injury if not performed properly or if certain safety procedures are not followed. The word **NOTE** is used to bring attention to the user of certain procedures or helpful hints that will aid in the disassembly and assembly steps.

Roll and Leak Testing

Torque-hub units should always be roll and leak tested before disassembly and after assembly to make sure that the unit's gears, bearings and seals are working properly. The following information briefly outlines what to look for when performing these tests.

NOTE: The brake must be released before performing the roll test. This can be accomplished by either pressure test by brake leak test below or by inserting the 11 bolts (item 1A1) to back side of inner plate (item 1A3) on exploded view. NOTE: Bolts (item 1A1) must be removed while performing brake release test.

The Roll Test

The purpose of the roll test is to determine if the unit's gears are rotating freely and properly. You should be able to rotate the gears in your unit by applying constant force to the roll checker. If you feel more drag in the gears only at certain points, then the gears are not rolling freely and should be examined for improper installation or defects. Some gear packages roll with more difficulty than others. Do not be concerned if the gears in your unit seem to roll hard as long as they roll with consistency.

The Leak Test (Main Unit)

The purpose of a leak test is to make sure the unit is air tight. You can tell if your unit has a leak if the pressure gauge reading on your air checker starts to fall once the unit has been pressurized. Leaks will most likely occur at the pipe plugs, the main seal or wherever o-rings or gaskets are located. The exact location of a leak can usually be detected by brushing a soap and water solution around the main seal and where o-rings or gaskets meet on the exterior of the unit, then checking for air bubbles. If a leak is detected in a seal, o-ring or gasket, the part must be replaced, and the unit rechecked. Leak test at 10 psi for 20 minutes.

The Brake Test

Reference: Sample Model CT35A310E4110D. The underlined letter is the brake option. Options are D, E, F or 0.

D Input Brake	=	3250 in./lbs. (367n.m) Static (6 spring) Initial Release 77 to 91 p.s.i. (6-7 bar) Full Release 110 p.s.i. (8 bar) Maximum O-ring Check 3000 p.s.i. (210 bar)
E Input Brake	=	4335 in./lbs. (490 n.m) Static (8 spring) Initial Release 103-121 p.s.i. (8-9 bar) Full Release 140 p.s.i. (10 bar) Maximum O-ring Check 3000 p.s.i. (210 bar)

F Input Brake	=	5960 in./lbs. (673 n.m.) Static (11 spring)
		Initial Release 142-166 p.s.i. (10-11 bar)
		Full Release 200 p.s.i. (14 bar)
		Maximum O-ring Check 3000 p.s.i. (210 bar)
0	=	No Brake

If brake does not release at these pressure valves, brake has to be inspected, repaired or replaced.

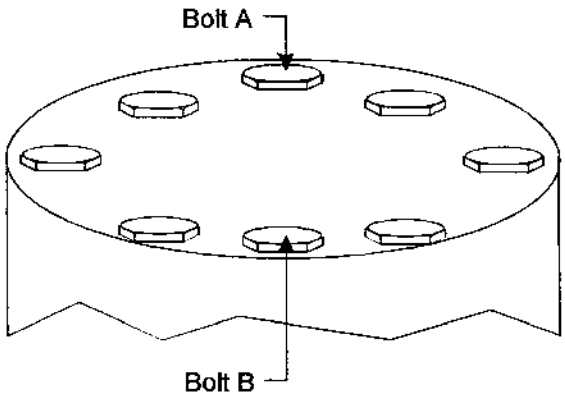
NOTE: Failure to perform this test may result in damaged or ineffective brake parts.

Tightening and Torquing Bolts

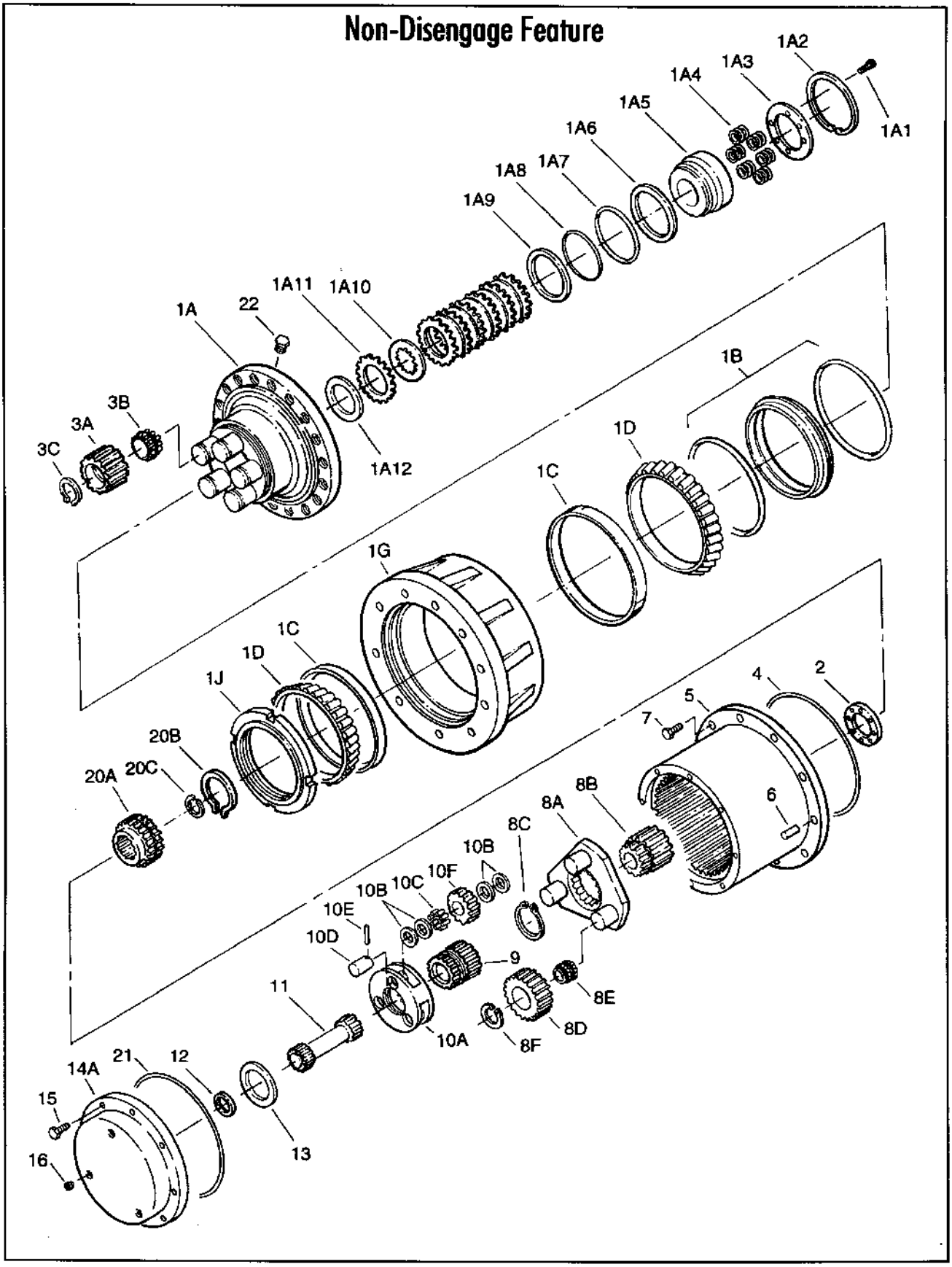
If an air impact wrench is used to tighten bolts, extreme care should be taken to insure that the bolts are not tightened beyond their specified torque.

The following steps describe how to tighten and torque bolts or socket head cap screws in a bolt circle.

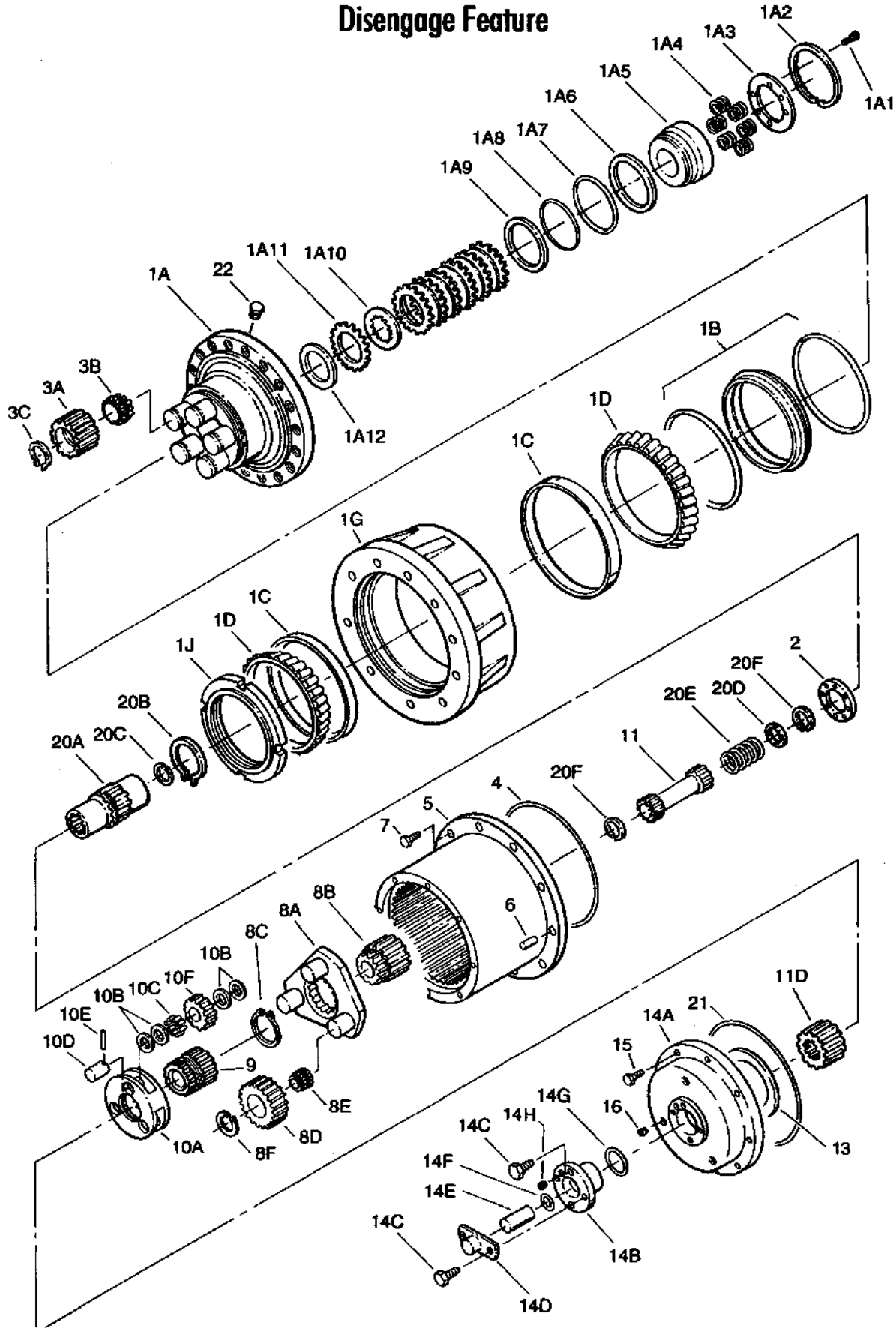
1. Tighten (but do not torque) bolt "A" until snug.
2. Go to the opposite side of the bolt circle and tighten bolt "B" until equally snug.
3. Crisscross around the bolt circle and tighten remaining bolts.
4. Now use a torque wrench to apply the specified torque to bolt "A".
5. Using the same sequence, crisscross around the bolt circle and apply an equal torque to the remaining bolts.



Main Disassembly



Disengage Feature



1. Remove pipe plugs (16) and drain the oil from the unit. On units with brakes, insert and tighten eleven M5X20 socket head screws (1A1) to compress the springs and relieve pressure on retaining ring.

   Perform the roll test on the unit. Use the same number of turns as the ratio of the unit. For example, on model CT35A310E4110D, the ratio is 110. The test would require 110 turns clockwise and 110 turns counterclockwise.

   Leak test the unit at pressure of 8-10 PSI for 10-15 minutes. Mount motor to seal end of the spindle cavity to seal unit for pressure test.

   To make a pressure gauge: Get a pipe plug adapter to thread into the pipe plug hole and threaded pipe to the other end. Attach a pressure gauge, then a shutoff valve, then an air inlet.

2. Remove twelve cover bolts (15).

3. Remove the cover (14A) or cover sub-assembly (14A-14H). Remove thrust washer (13).

4. Remove and discard o-ring (21).

NOTE: Step 5 applies to units without the Input Disengage Feature only.

5. Remove thrust washer (12). NOTE: The thrust washer may have stuck to the cover when it was removed. (Solid cover only. Disengage units will not have item [12].)

6. Remove the first stage sun gear input shaft (11) on non-disengage unit (item 11D on disengage unit).

7. Remove carrier sub-assembly (10A).

8. Remove sun gear (9).

9. Remove carrier sub-assembly (8A), sun gear (8B) will come along with the carrier.

NOTE: Step 10 is for units with Input Disengage Feature.

10. With retaining ring pliers, remove retaining ring (20F), remove input shaft (11), remove spring (20E), and thrust washer (20D). It is not necessary to remove the other retaining ring (20F) unless it is damaged.

11. Remove two bolts (7).

12. Remove ring gear (5).

13. Remove the o-ring (4) and discard.

14. It is not necessary to remove the two dowel pins (6) unless they are damaged.

15. Using retaining ring pliers, remove five retaining rings (3C) from spindle (1A). NOTE: Roller bearings (3B) are pressed onto spindle (1A) and locked into the planet gears (3A). If planet gears are damaged or roller bearings are damaged or worn, both parts must be replaced.

16. Pry off planet gears (3A).

NOTE: Do not damage input spacer (2).

17. Remove coupling (20A). Remove retaining ring (20B) from coupling (20A). Remove retaining ring (20C) if damaged (only).

NOTE: Units without brakes will not have retaining ring (20B).

(continued on next page)

18. Loosen and remove the bearing nut (1J) from spindle (1A). Locknut fixture T-174681.

NOTE: The swedged (bent) locknut material must be ground off to remove the bearing nut. Locknut is loctited on so heat to break down loctite. Locknut will be scrap after being removed.

19. Turn spindle over onto its' planet gear post. Use a dead blow hammer on the housing's flange (1G) to drive the bearing cone (1D) off of the spindle (1A).

20. Lift the spindle (1A) out of the hub (1G).

21. Remove the seal (1B) from the housing (1G) and spindle (1A).

NOTE: Take care not to damage the counterbores where the cups are housed.

22. Using a hammer and soft punch, remove the bearing cups (1C) from the housing (1G).

23. Remove the bearing cone (1D) from the spindle (1A). Heat may be required.

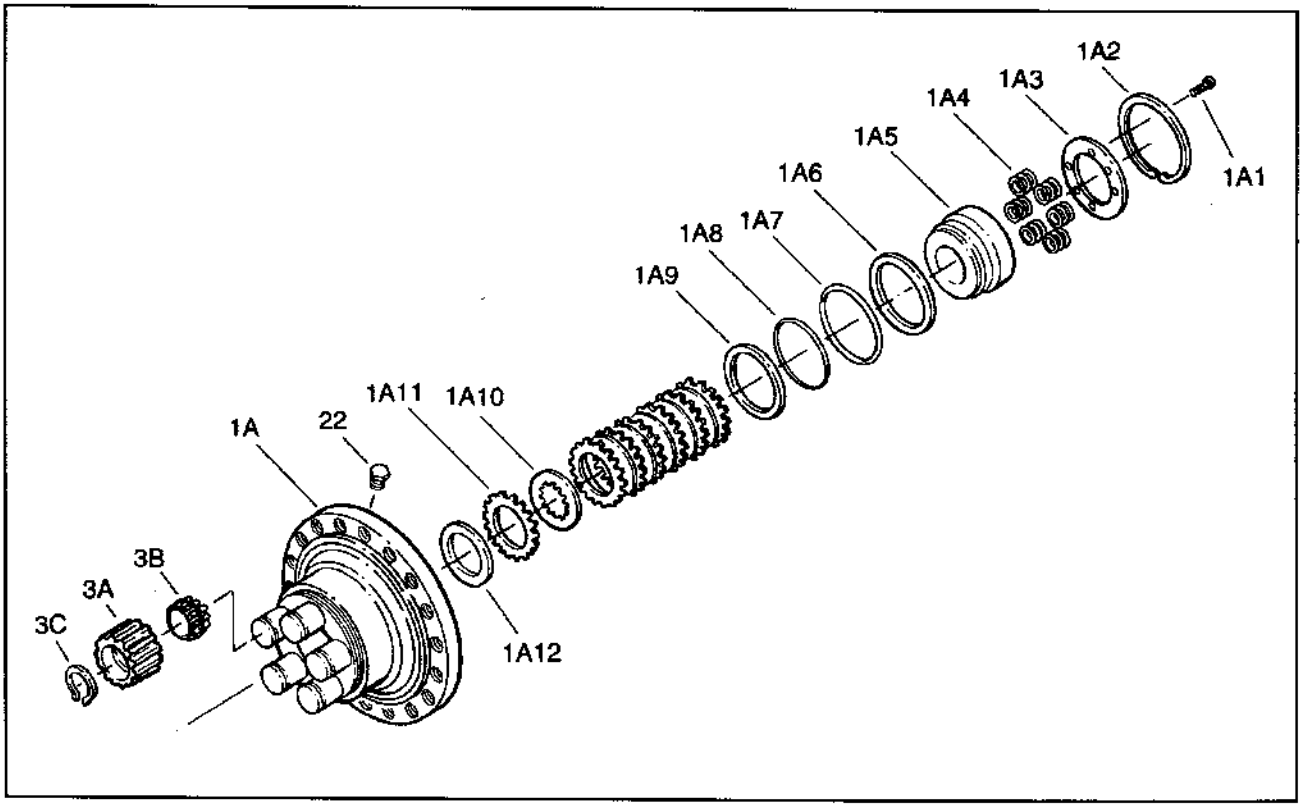
Removal of Mounting Adapter (If Applicable)

24. Remove four bolts (27).

25. Remove mounting adapter (25).

26. Remove o-ring (26) and discard.

Input Brake Disassembly



NOTE: Make sure the eleven bolts in step #1 are in place before the next step.

CAUTION: Safety glasses must be worn during this step.

1. Using snap ring pliers, remove the retaining ring (1A2) which holds the input brake sub-assembly (1A3-1A12) in place.

2. Lift the input brake sub-assembly (1A3 through 1A5) out of the spindle (1A). If the input brake sub-assembly will not lift out, reinstall the external retaining ring (20B) and coupling (20A) and use a dead blow hammer to lightly tap the input brake sub-assembly out of the spindle (1A). Remove the coupling (20A) and retaining ring (20B) when the input brake is removed.

NOTE: As an alternative to step #2, the spindle port can be pressurized with air or hydraulic oil hand pump to push the piston out of the spindle.

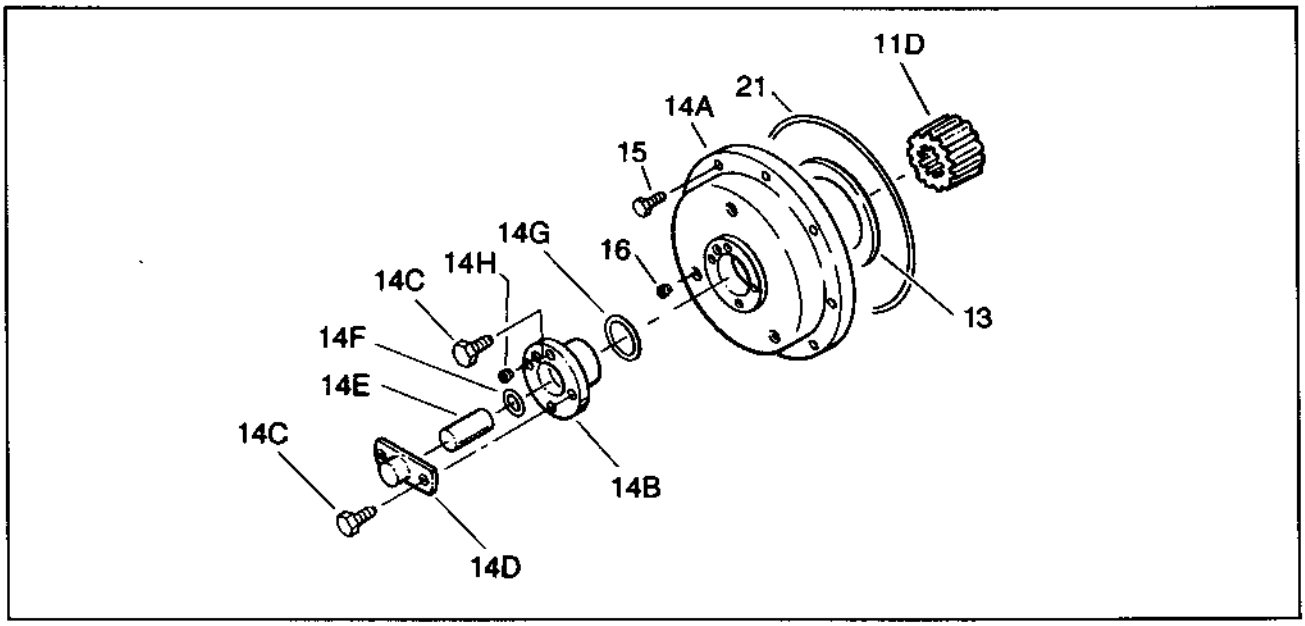
3. Remove the anti-extrusion rings (1A6 and 1A9) and o-rings (1A7 and 1A8) from the spindle (1A).

4. Remove the inner plates (1A10) and outer plates (1A11) from the spindle (1A).

5. Remove the end plate (1A12) from the spindle (1A).

NOTE: If unit has the disengage feature and both the gear box and brakes have been completely disassembled for inspection, do not build input brake subassembly at this time. See page 18 step 29.

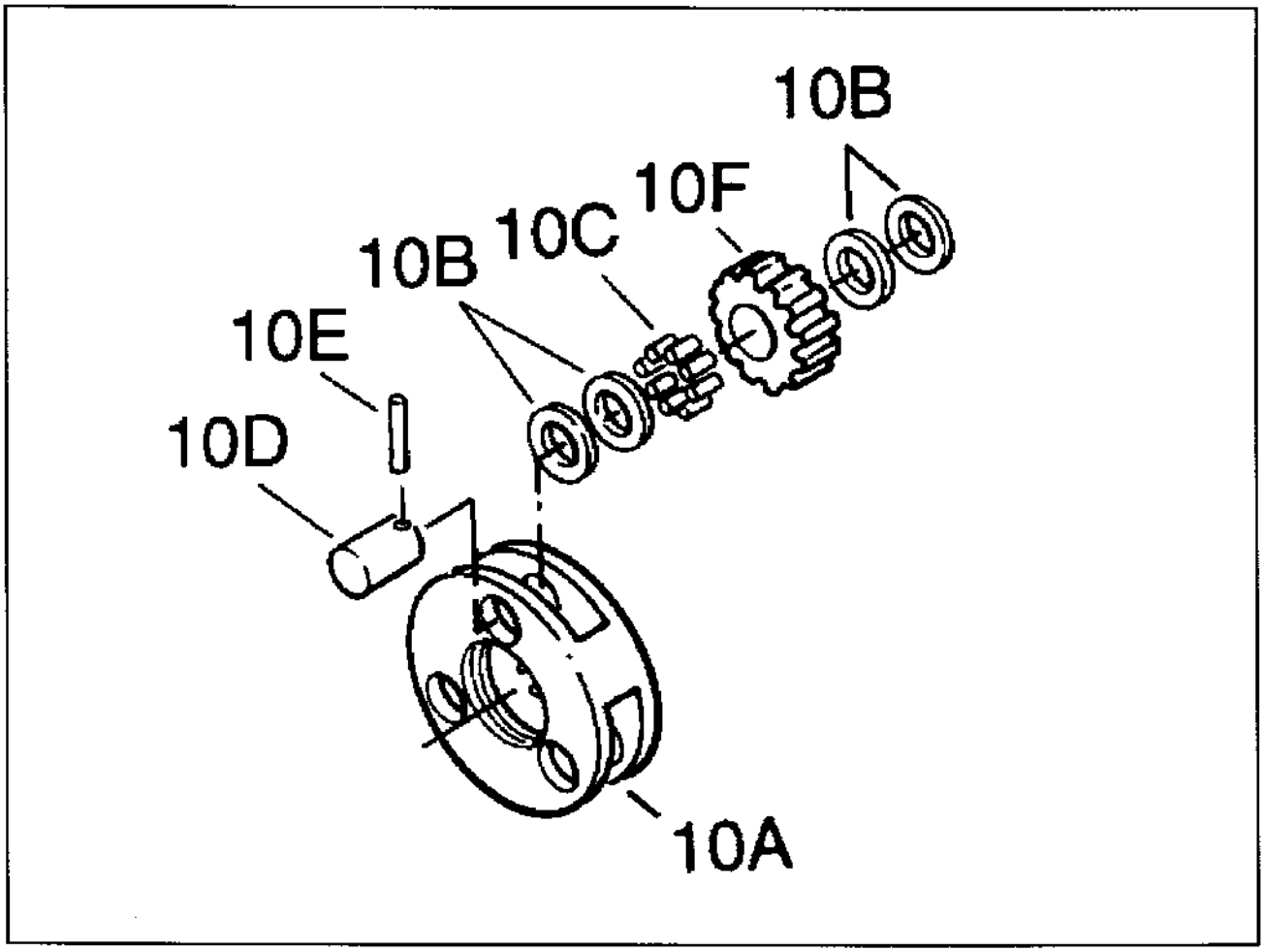
Cover Disassembly



NOTE: This procedure applies only to units with Input Disengage feature.

1. Remove the two hex bolts (14C) which hold the disengage cap (14D) in place.
2. Remove the disengage cap (14D).
3. Remove the two hex bolts (14C) which secure the cover cap (14B) in place.
4. Lift the cover cap (14B) out of the cover (14A).
5. Lift the disengage rod (14E) out of the cover cap (14B).
6. Remove and discard the o-ring (14G) from the outside of the cover cap (14B).
7. Pry the small o-ring (14F) from inside the cover cap (14B) and discard the o-ring.
8. Remove the pipe plug (14H).

First Stage Carrier Disassembly



1. Drive the roll pin (10E) which holds the planet shaft (10D) in the carrier housing (10A). Drive the roll pin (10E) down into the planet shaft (10D) until it bottoms.

CAUTION: Make sure the pin has bottomed. Otherwise, damage to the carrier housing could occur when the shaft is removed.

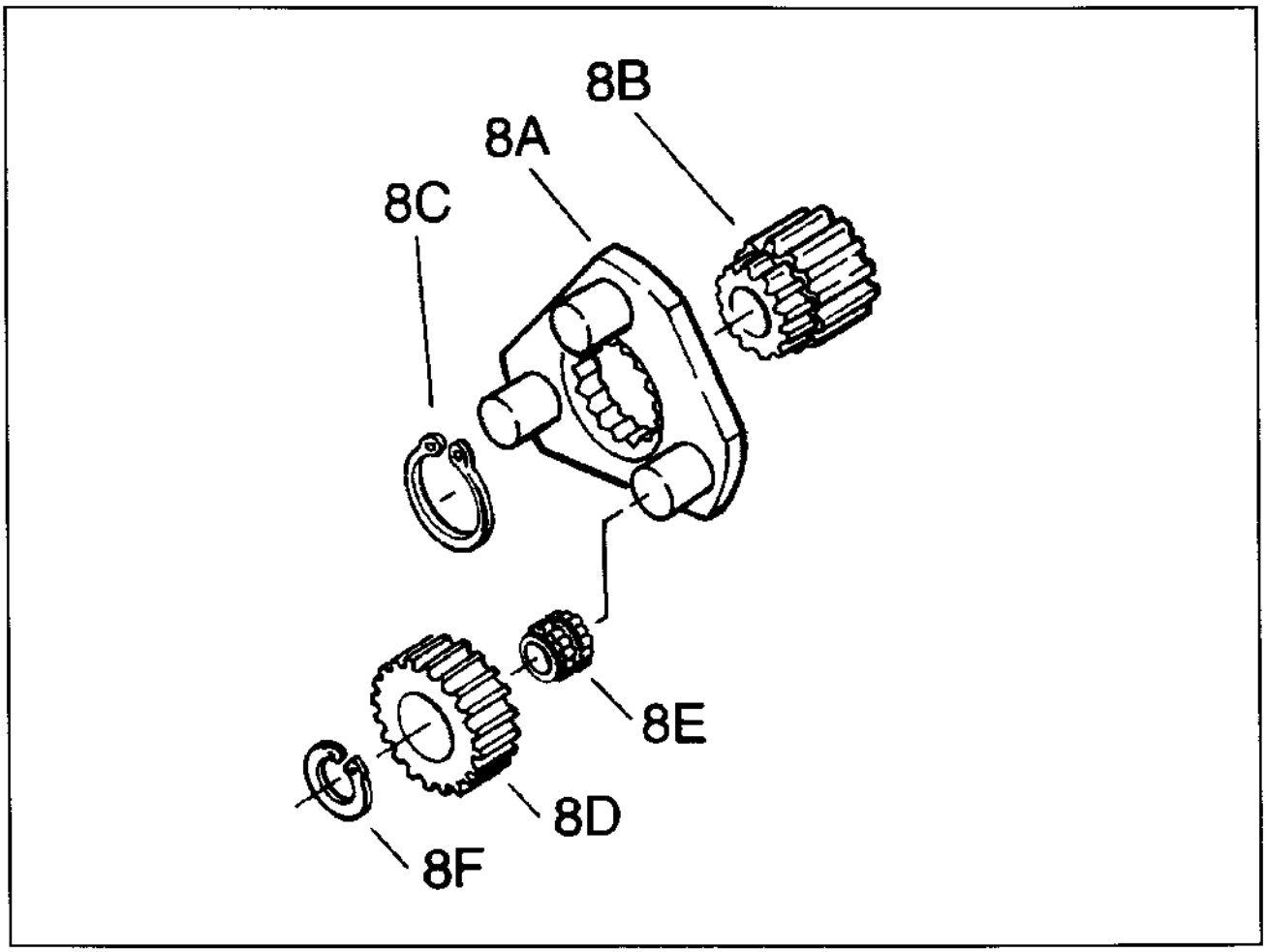
2. Remove the planet shaft (10D) from the carrier housing (10A). Remove the roll pin (10E) from the planet shaft (10D).

3. Slide the planet gear (10F) and four thrust washers (10B) out of the carrier housing (10A).

4. Remove 19 needle bearings (10C) from the inside of the planet gear (10F).

5. Repeat steps 1 through 5 for each of the two remaining planet gears.

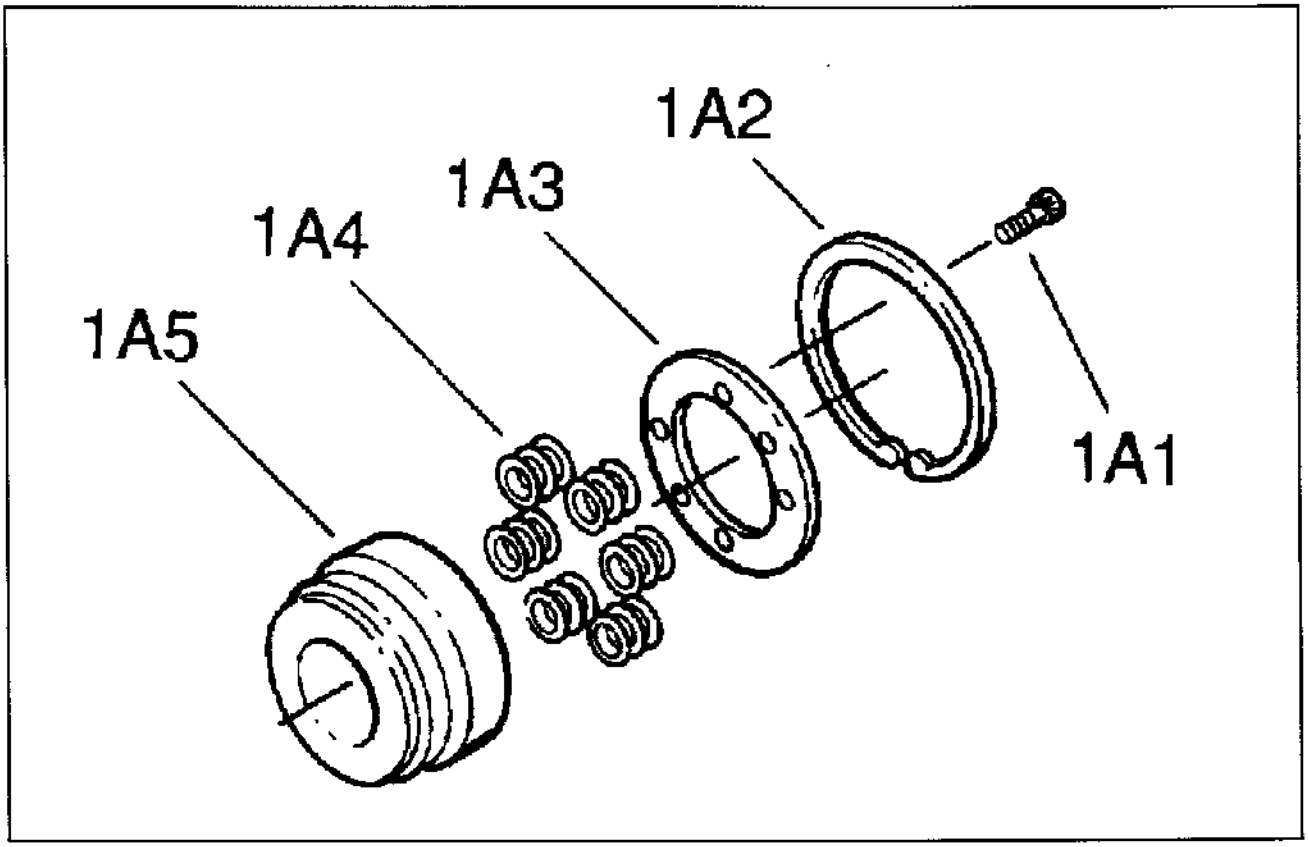
Second Stage Carrier Disassembly



NOTE: Safety glasses must be worn during this step.

1. Using snap-ring pliers, remove three retaining rings (8F).
2. Planet gears (8D) must be pried off of carrier housing (8A).
3. Roller bearings (8E) can not be removed from planet gears (8D) if either are damaged. Both have to be replaced.
4. Remove retaining ring (8C).
5. Remove sun gear (8B).

Input Brake Disassembly



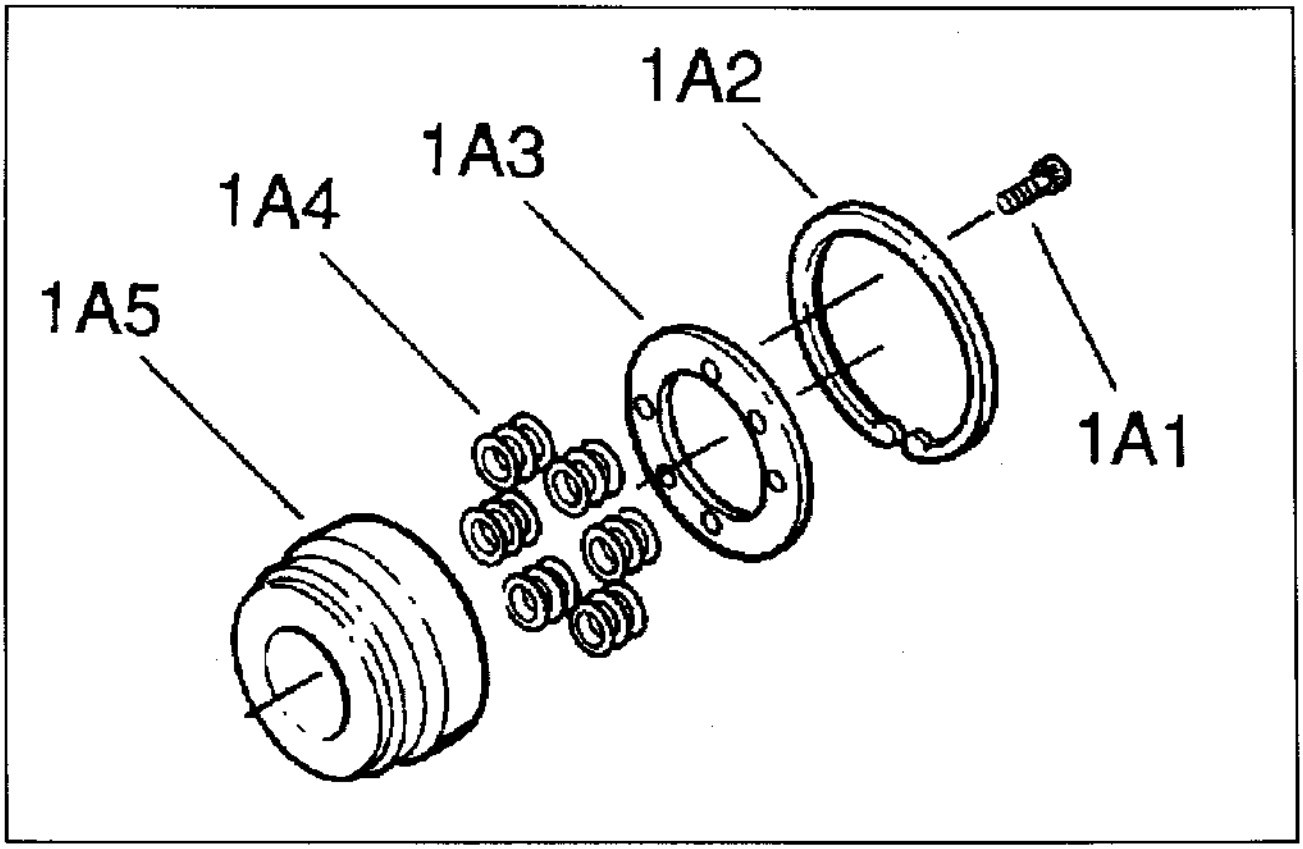
1. Remove the 11 socket head screws (1A1).

2. Lift the thrust plate (1A3) from the piston (1A5).

NOTE: Brakes may have 6, 9, or 11 springs. Mark location of springs if your brake has less than 11 springs.

3. Remove the springs (1A4) from the piston (1A5).

Input Brake Subassembly

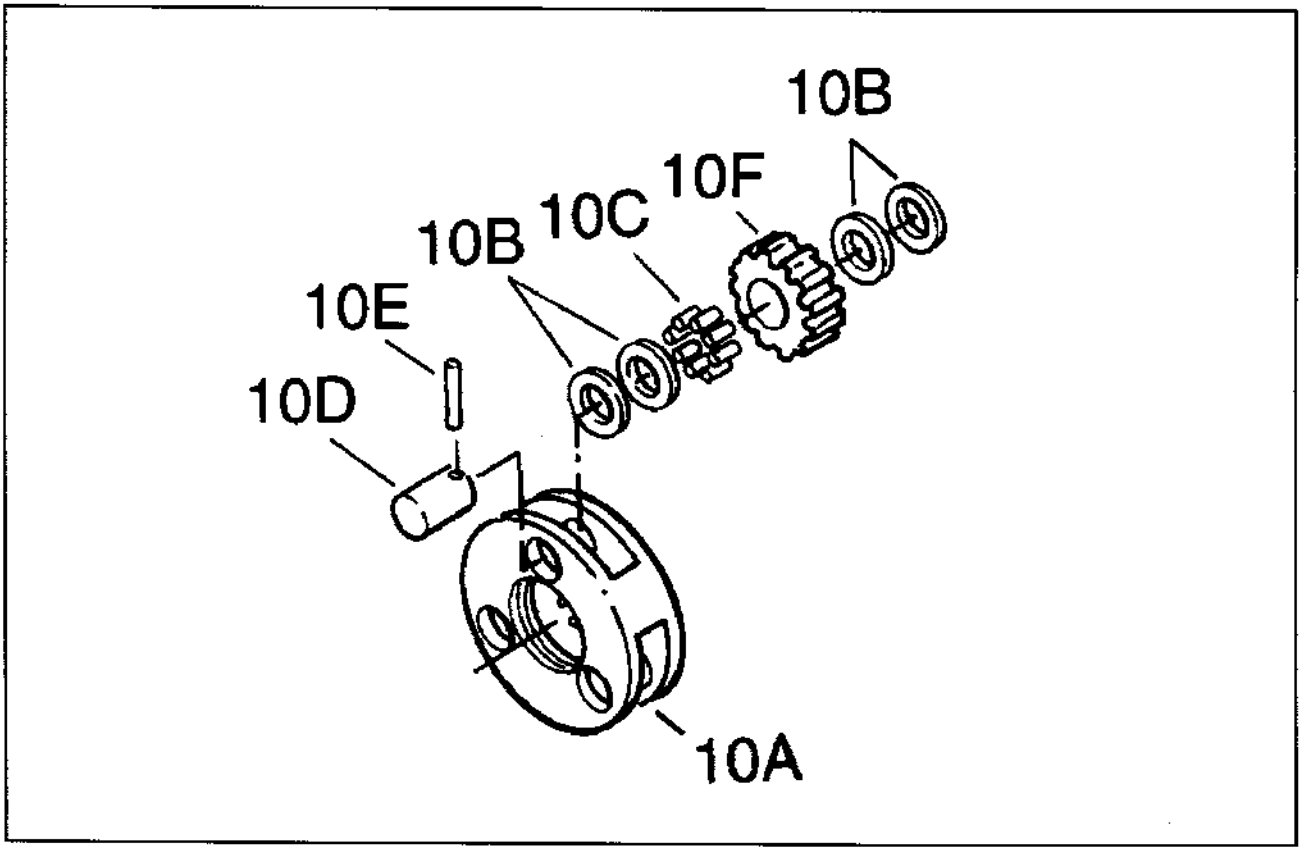


1. Install springs (1A4) into the piston (1A5).
2. Position the thrust plate (1A3) on the piston (1A5), aligning the screw holes.

NOTE: Start all screws and use press to clamp together, then tighten screws.

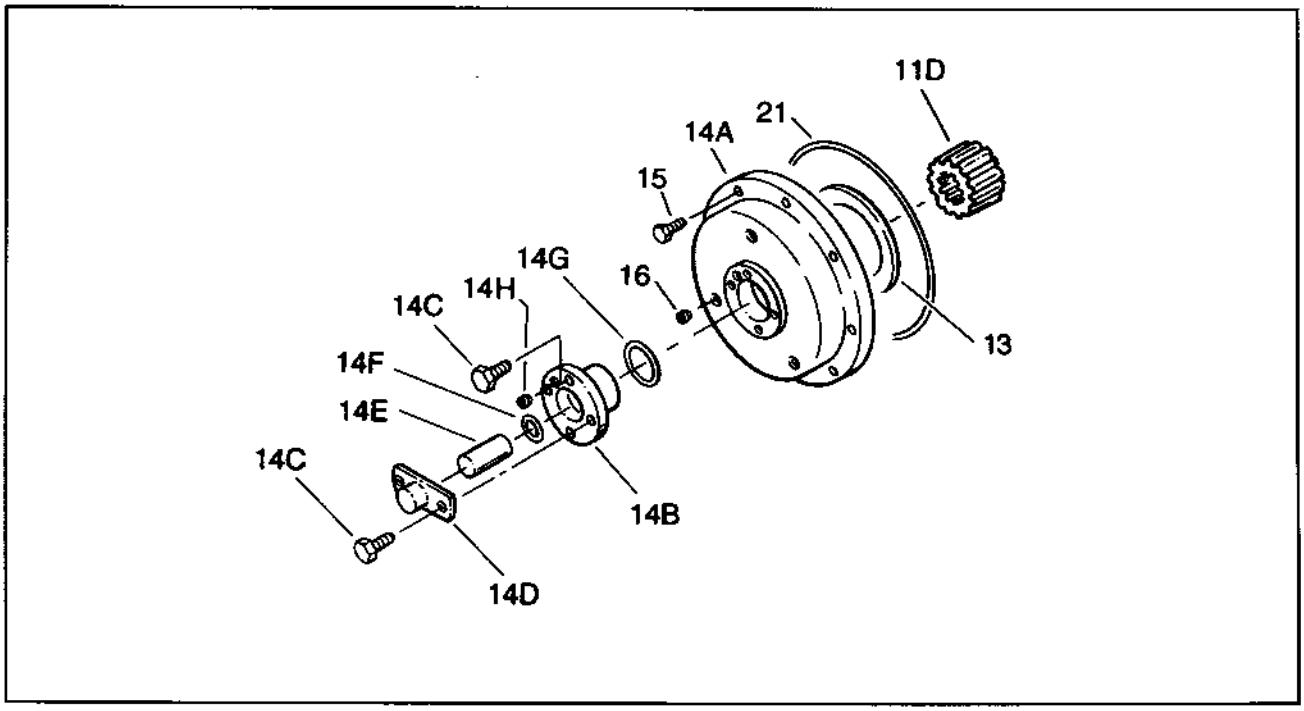
3. Install and tighten 11 socket head screws M5X20 (1A1).

First Stage Carrier Subassembly



1. Apply a light coat of grease to the inside of one of the first stage planet gears (10F).
2. Line the inside of the planet gear (10F) with 19 needle roller bearings (10G).
3. Stand the carrier housing (10A) on its side, or fixture T-174692.
4. Insert the planet shaft (10D) approximately 1/2" into the planet shaft hole on the carrier housing (10A). Be sure to insert the end of the shaft without a roll pin hole into the side of the housing with a roll pin hole. The chamfered roll pin hole in the planet shaft should face upward.
5. Apply a light coat of grease to two thrust washers (10B) and place the thrust washers onto the end of the planet shaft (10D) which has been inserted in the housing.
6. Place the planet gear (10F) lined with needle roll bearings (10E) onto the planet shaft (10I).
7. Apply a light coat of grease to two thrust washers (10B) and place the thrust washers onto the planet shaft (10D).
8. Push the planet shaft (10D) through the hole on the opposite side of the carrier housing (10A).
9. Using an alignment punch or similar tool, align the roll pin holes in the carrier housing (10A) and the planet shaft (10D).
10. Drive the smaller end of the roll pin (10E) into the aligned holes, until the top of the pin is about 1/10 inch below the housing surface.
11. Repeat steps 1 through 10 for the remaining two planet gears.

Cover Subassembly



1. Apply pipe thread sealant to the pipe plugs (16 & 14H).
2. Install pipe plugs (16 & 14 H) into cover (14A).

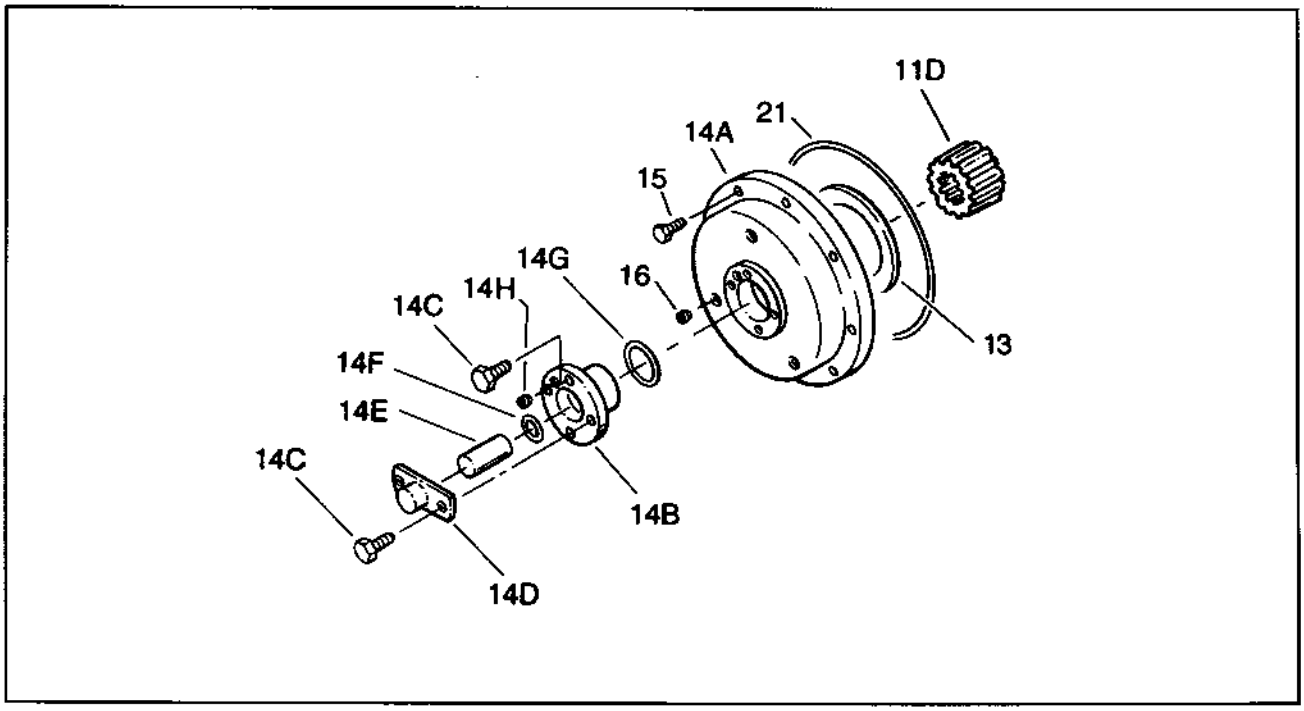
NOTE: Do not re-use o-rings.

3. Place new o-ring (14G) onto the cover cap (14B), against the underside of the flange.

NOTE: Do not re-use o-rings.

4. Install a new o-ring (14F) inside the cover cap (14B) making sure the o-ring is seated in the groove.
5. Insert the cover cap (14B) into the center opening of the cover, making sure to align the bolt holes.
6. Install and tighten two hex bolts (14C) in holes which go all the way into the cover.
7. Insert the disengage rod (14E) into the cover cap (14B).
8. Position the disengage cap (14D) into the cover cap (14B).
9. Install and tighten the two hex bolts (14) to secure the disengage cap. Torque to 8-10 ft./lbs.
10. Grease and install o-ring (21) onto cover (14A).
11. **NOTE:** If unit has a solid cover (no disengage), grease and install thrust washer (12) into cover (14).

Cover Subassembly



1. Apply pipe thread sealant to the pipe plugs (16 & 14H).
2. Install pipe plugs (16 & 14 H) into cover (14A).

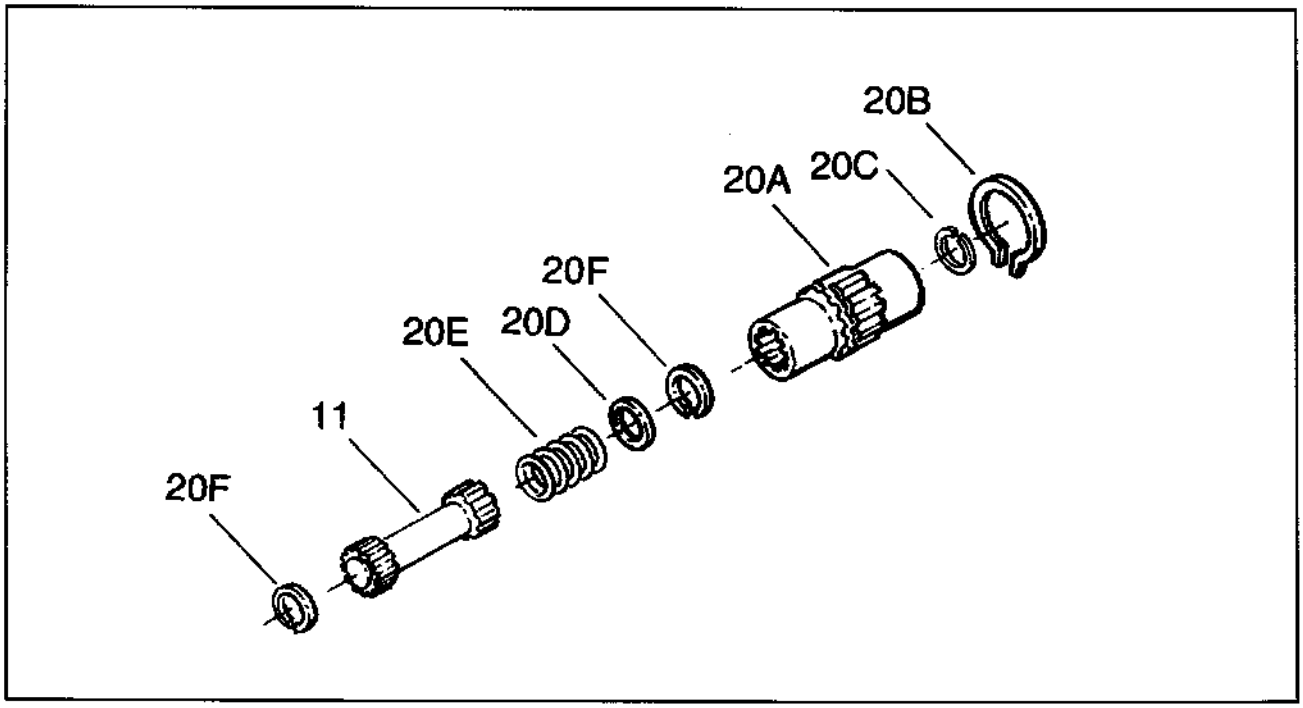
NOTE: Do not re-use o-rings.

3. Place new o-ring (14G) onto the cover cap (14B), against the underside of the flange.

NOTE: Do not re-use o-rings.

4. Install a new o-ring (14F) inside the cover cap (14B) making sure the o-ring is seated in the groove.
5. Insert the cover cap (14B) into the center opening of the cover, making sure to align the bolt holes.
6. Install and tighten two hex bolts (14C) in holes which go all the way into the cover.
7. Insert the disengage rod (14E) into the cover cap (14B).
8. Position the disengage cap (14D) into the cover cap (14B).
9. Install and tighten the two hex bolts (14) to secure the disengage cap. Torque to 8-10 ft./lbs.
10. Grease and install o-ring (21) onto cover (14A).
11. **NOTE:** If unit has a solid cover (no disengage), grease and install thrust washer (12) into cover (14).

Input Shaft/Coupling Subassembly



1. Place input coupling (20A) on table.
2. With safety glasses on, install retaining ring (20C).
3. With safety glasses on, install retaining ring (20F).
4. Install washer (20D).
5. Install spring (20E).
6. Install input shaft (11). Press down and install retaining ring (20F).
7. With safety glasses on , install retaining ring (20B).

Main Assembly

1. Place spindle (1A) on table with planet shaft post up.

2. Grease and install input spacer (2).

3. Install the new bearing nut (1J) on the spindle (1A) and torque to 200 ft./lbs. (dry), using locknut wrench T-174681.

4. Mark both the nut and spindle with a reference line to indicate the minimum final position of the nut.

5. Remove the bearing nut (1J).

NOTE: Do not re-use seals.

6. Install one half of a new face seal (1B) onto the spindle (1A) according to the seal installation instructions attached.

7. Apply a light coat of oil to the bearing cups (1C).

8. Press two bearing cups (1C) into the housing (1G) with the largest inside diameter of the cup facing outward. An arbor type press, if available, is best for this operation. If not, a bearing installation tool and rubber hammer should be used. Bearing cup tool T-174687.

9. Apply a light coat of oil to the two bearing cones (1D).

10. Install bearing cone (1D) into housing (1G).

11. Install the second half of new face seal (1B) into hub (1G) according to the seal installation instructions on page 19.

12. Install the housing (1G) over the spindle (1A) with the largest inside diameter facing downward. Set on bearing (1D) onto spindle. Using tool T-174680, tap bearing down. NOTE: This is a slip fit. Do not get your fingers caught under hub; have the hub support by hand on O.D. If hub drops down hard, it could damage the bearing.

13. Install bearing cone (1D) using tool T-174680.

14. Install the bearing nut (1J) onto the spindle (1A), using locknut wrench. Apply 277 loctite to threads before installation. Tighten and torque to a minimum of 700 ft. lbs. Make sure the nut is at or past the reference line marked in step 12. Locknut nut wrench T-174681.

15. Stake the bearing nut (1J) in three places, using a hammer and punch.

NOTE: Gears (3A) are a matched set. If you are replacing one, all must be replaced. If the bearing or gear needs to be replaced, both must be replaced, as the assembly of the components is permanent. If a bearing or gear is being replaced, proceed to step 17. If not, skip to step 18.

16. Center the bearing (3B) and retainer on the end of the planet gear (3A) with the large chamfer on its inside diameter and push the bearing through the retainer into the gear until it snaps into the groove of the gear.

17. Press the roller bearing (3B) and planet gear (3A) assembly onto a planet shaft of the spindle (1A), using pressing tool. T-174699.

NOTE: Chamfer end of bearing goes onto planet shaft first. Tap fixture with a rubber hammer to install. If you use a hard hammer, most likely you will crack the inner bearing race.

(continued on next page)

Main Assembly, continued

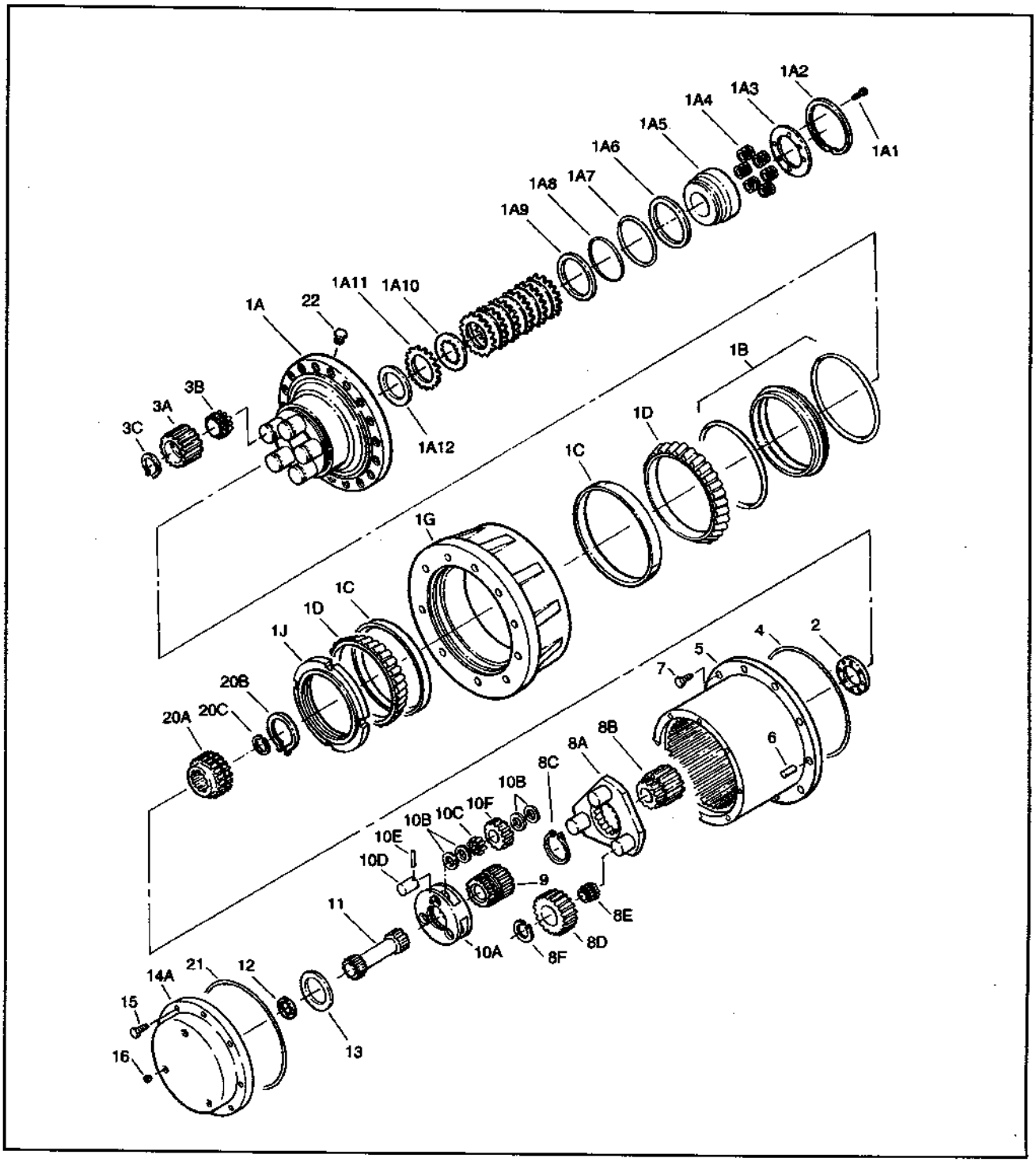
CAUTION: Safety glasses must be worn during this step.

18. Using snap-ring pliers, install the new external retaining ring (3C) on the planet shaft to hold the planet gear/bearing in place.

19. Repeat steps 17 through 18 as required, to install the remaining four planet gears (3A) and roller bearing (1B) assemblies.

20. Grease and install o-ring (4) onto housing (1G).

21. Install the housing (5) onto hub (1G). Align bolt



hole and dowel pin hole. Install two dowel pins (6) and two bolts (7) torque to bolt (7), 18-25 ft./lbs.

Install carrier assembly (8A second stage carrier subassembly) into ring gear (5).

22. Install sun gear (9) into carrier (8A).

23. Install carrier subassembly (10A) onto sun gear (9).

24. Install sun gear (11D) (if unit has disengage feature) or input shaft sun gear (11) if unit has solid cover.

25. Install cover sub-assembly with o-ring (4) and thrust washer (12), if unit has solid cover, onto ring gear (5).

26. Install twelve bolts (15) and torque to 18 to 25 ft./lbs.

27. Turn unit over onto its cover (14A).

28. Install input shaft/coupling sub-assembly or input coupling (20A). NOTE: Make sure retaining ring (20B) is on its O.D. if unit has a brake.

29. Place the input brake end plate (1A12) on the flange at the bottom of the spindle opening.

30. Install the outer plates (1A11) and inner plates (1A10) alternately into the spindle (1A).

NOTE: Do not re-use anti-extrusion rings.

31. Install a new anti-extrusion ring (1A9) in the lower groove in the inside was of the spindle (1A).

NOTE: Do not re-use o-rings.

32. Install a new o-ring (1A8) above the anti-extrusion ring (1A9).

NOTE: Do not re-use o-rings.

33. Install a new o-ring (1A7) in the upper groove in the inside was of the spindle (1A).

NOTE: Do not re-use anti-extrusion rings.

34. Install a new anti-extrusion ring (1A6) above the o-ring (1A7).

NOTE: Lightly grease cylinder walls of spindle assembly to minimize shearing of o-rings and anti-extrusion rings.

35. Install the input brake sub-assembly (1A3 through 1A5) into the spindle (1A).

CAUTION: Safety glasses must be worn during this step.

36. Using snap-ring pliers, install the retaining ring (1A2) to hold the input brake sub-assembly (1A3 through 1A12) in place.

37. At this time, using fixture T-182969, roll check the unit. After the roll check, remove the eleven M5X20 socket head cap screws. If ratio is CT35A310E110D=110 ratio, rotate 110 input turns for one output turn. Rotate both directions 110 input turns.

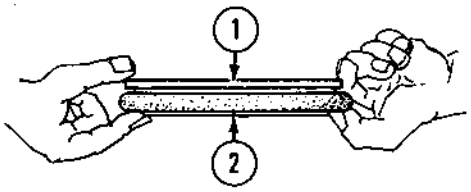
38. Leak test unit at 8-10 psi for a period of 10-15 minutes. Tool T-182777. Or, install motor with o-ring. Pressure test to be taken through a cover pipe plug (16). See step #1 on how to make a pressure gauge.

39. Perform a pressure check of the input brake (refer to brake test, page III).

Seal Installation Instructions

Seal rings, torics and housings must be clean and free of any oil film, dust or other foreign matter. Use a solvent that evaporates quickly, leaves no residue and is compatible with the rubber toric rings. The recommended solvent is 1-1-1 Trichloroethane. (NOTE: Follow all safety guidelines for use on the solvent's Material Safety Data Sheet.) Ring and housings should be wiped with a solvent soaked, lint free cloth or paper towel.

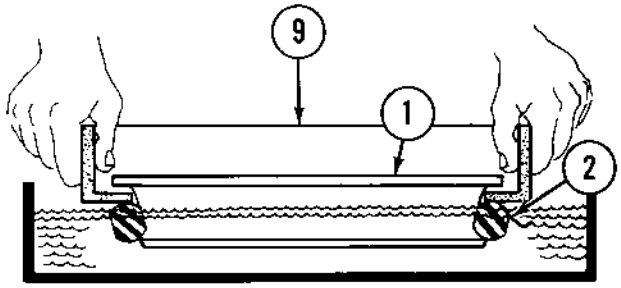
After all components have been wiped clean, the torics should be installed on the metal seal rings so that they rest in the radius on the tail of the metal ring. Insure that the torics are not twisted by inspecting the mold flash line on the outside diameter of the toric for true circumferential tracking around the seal. Twisted torics will cause non-uniform face load that can result in leakage of lubricant and pumping of debris past the toric. If a twist is apparent, it can be eliminated by gently pulling a section of the toric radially away from the metal seal ring and letting it "snap" back. Repeating this in several places around the ring will eliminate any twist in the toric ring.



Eliminate toric twist by gently pulling a section of the toric (2) rapidly away from the seal ring (1) and letting it "snap" back.

After the torics are installed on the seal rings, the seal assembly is ready to be installed into the retainer housing. It is recommended to use installation tools available through Fairfield to insure accurate assembly. These durable installation tools are designed to locate on the toric ring and slide it past the housing retaining lip. A second locator is designed into larger seal installation tools to insure the proper seal standout height. Improper seal assembly installation into the retainer housing can result in poor seal performance due to non-uniform loading. Duo-Cone Seal installation tools help insure precise installation.

Place the installation tool around the seal ring and dip the seal ring into a pan of 1-1-1 Trichloroethane solvent to lubricate the toric ring. It is essential to lubricate the toric with Trichlor so that the toric will slip past the housing retaining lip and seal uniformly in the housing nose radius. Insufficient lubrication can cause poor seal performance due to non-uniform loading (twisted torics or cocked seals). Use of solvents other than 1-1-1 Trichloroethane can leave a residue on the toric or ramps and allow the toric to slide rather than roll in the seat. This can also result in poor seal performance due to non-uniform loading.



Put the installation tool (9) onto the seal ring (1) with toric ring (2). Lower the rings into a container with Trichloroethane until all surfaces of the toric (2) are wet.

After dipping the seal assembly in the solvent, shake the excess solvent from the seal assembly and immediately "pop" the seal into the housing with a firm push of the installation tool. Remove the installation tool and check the seal standout height at several places around the circumference of the ring to verify an accurate installation. If the seal does not meet the height specification, inspect the toric for twists or obvious bulges.

(continued on next page)

Seal Installation, continued

Seal Ring Standout-Height

Toric Cross Section Ø in (mm)	Seal Ring Outside Ø in (mm)	Assembled Height Dimension* in (mm)	Installation Tool	
			8°	15°
0.373 (9.47)	3.25 (82.55)	0.35 ± .02 (8.8 ± 0.6)	—	1U8843
0.373 (9.47)	3.63 (92.08)	0.35 ± .02 (8.8 ± 0.6)	—	1U8840
0.245 (6.22)	4.13 (104.78)	0.30 ± .02 (7.7 ± 0.6)	—	1U8850
0.373 (9.47)	4.31 (109.52)	0.35 ± .02 (8.8 ± 0.6)	—	1U8841
0.373 (9.47)	4.69 (119.08)	0.35 ± .02 (8.8 ± 0.6)	—	1U8842
0.245 (6.22)	5.56 (141.22)	0.30 ± .02 (7.7 ± 0.6)	—	1U8699
0.373 (9.47)	5.75 (146.05)	0.35 ± .02 (8.8 ± 0.6)	—	5S4275
0.245 (6.22)	6.18 (156.97)	0.30 ± .02 (7.7 ± 0.6)	—	1U8698
0.245 (6.22)	6.62 (168.15)	0.30 ± .02 (7.7 ± 0.6)	—	1U8697
0.50 (12.70)	6.76 (171.70)	(1)	—	1U6443
0.50 (12.70)	7.33 (191.26)	(1)	1U6442	1U6441
0.50 (12.70)	8.28 (210.31)	(1)	1U6440	1U6439
0.50 (12.70)	9.90 (251.46)	(1)	1U6437	1U6436
0.50 (12.70)	10.22 (259.59)	(1)	—	1U6438
0.50 (12.70)	11.53 (292.86)	(1)	1U6435	1U6434
0.50 (12.70)	13.64 (346.46)	(1)	1U5934	1U5933
0.50 (12.70)	15.53 (394.46)	(1)	8T7789	8T9206
0.50 (12.70)	18.00 (457.20)	(1)	—	8T0531
0.50 (12.70)	21.00 (533.40)	0.51 ± .05 (14.5 ± 1.2)	—	8T0530
0.50 (12.70)	27.56 (700.00)	0.51 ± .05 (14.5 ± 1.2)	—	(2)

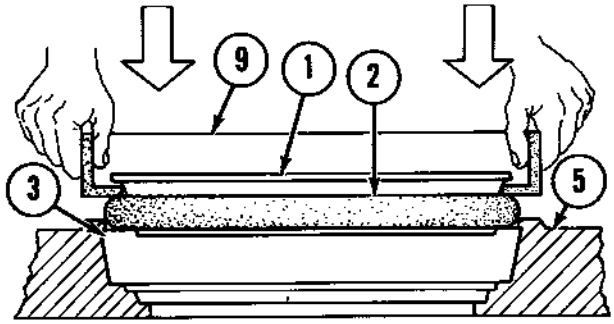
*0.039 in (1.0 mm) maximum variation per seal ring.
(1) 0.45 ± .04 in (11.50 ± 1.0 mm) for 15° ramp angle seals and 0.57 ± .04 in (14.6 ± 0.9 mm) for 8° ramp angle seals.
(2) Use 8T0527 Group consisting of 8T0528 Installer Assembly and 8T0529 Support Ring.

The seal can be adjusted by gently pushing the toric into position by hand or by using a fabricated adjustment hook. If the seal can not be adjusted to meet the standout height specification, remove the seal and repeat the procedure.

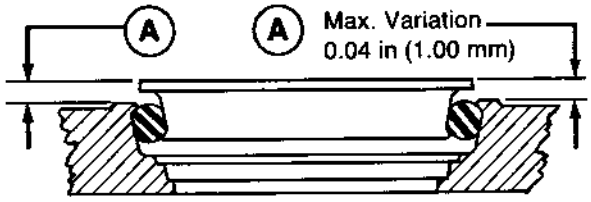
A thin film of light oil should be applied to the seal faces prior to assembly. Use an applicator, a disposable tissue or clean finger to distribute the oil on the rubber toric rings.

Be sure there is no visible debris on either of the seal faces - even a small piece of lint can hold the seal faces apart and cause leakage.

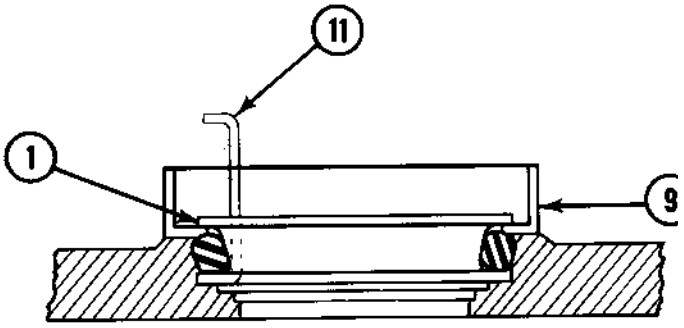
After successful installation, wait one minute for the Trichlor to dry before assembling the two seal halves in the final loaded position. This delay is to allow any excess solvent to dry so that the torics roll, rather than slide, in the housing as the faceload is increased. If the torics slide, this can produce a non-uniform load that can result in poor seal performance.



With all surfaces of the toric ring (2) wet with 1-1-1 Trichloroethane, use the installation tool (9) to position the seal ring (1) and the toric ring (2) squarely against the housing (5) as shown. Use sudden and even pressure to pop (push) the toric ring (2) under the retaining lip (3) of the housing (5).



Check the assembled height (A) in at least four places, 90° apart. Refer to the chart for standout height specification.

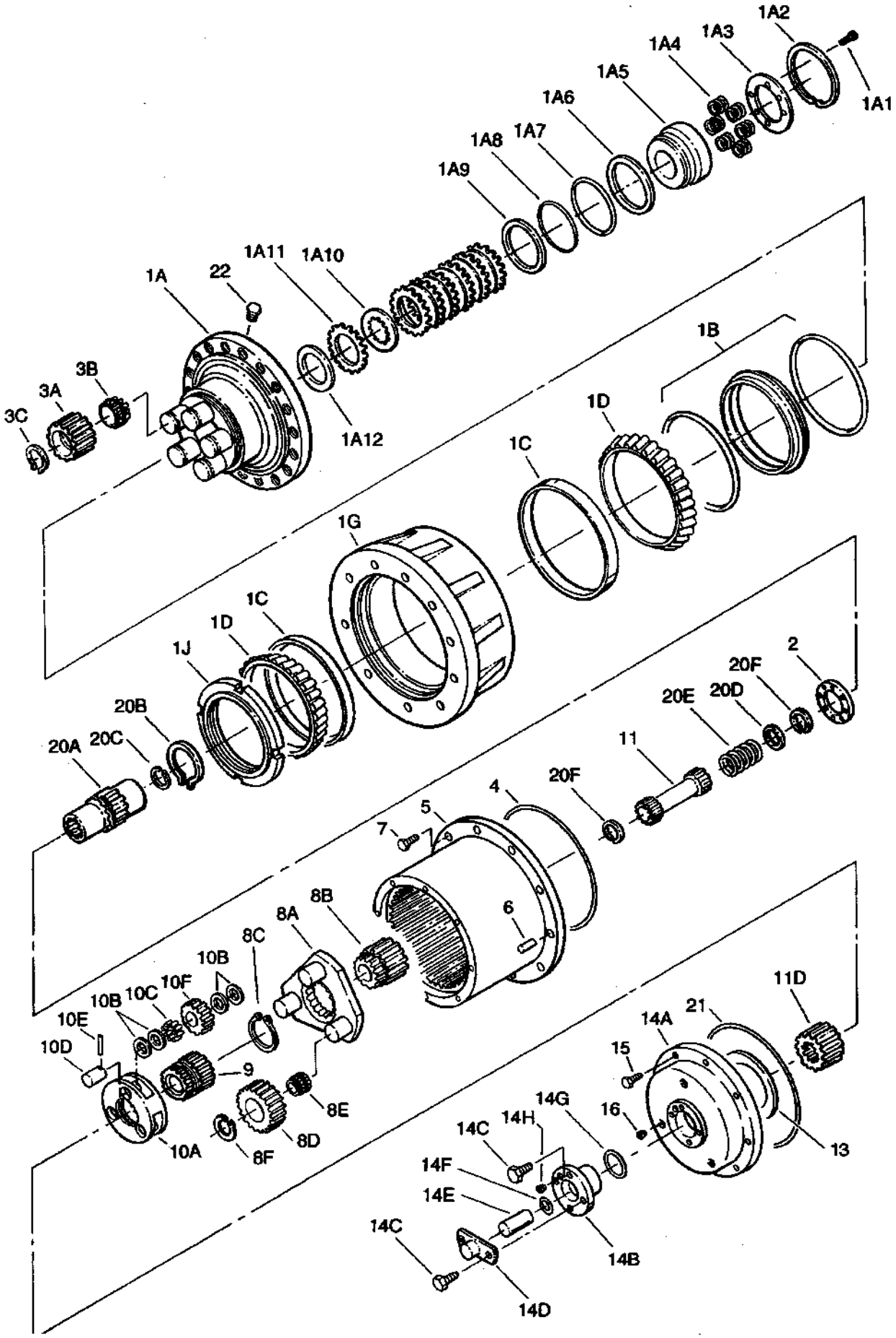


If small adjustments are necessary, do not push directly on the seal ring (1); use the installation tool (9) to push down or the adjustment tool (11) to pull up.

Parts List

This Parts List should be used if your model has the Input Disengage feature.

Item	Quantity	Description
1A	1	Spindle
1A1	11	Socket Head Cap Screws
		Input Brake Sub-Assembly
		(consists of items 1A2 through 1A13)
1A2	1	Internal Retaining Ring
1A3	1	Thrust Plate
1A4	6, 9, or 11	Spring
1A5	1	Piston
1A6	1	Dowty Anti-Extrusion Ring
1A7	1	Dowty O-Ring
1A8	1	Dowty O-Ring
1A9	1	Dowty Anti-Extrusion
1A10	6	Inner Plates
1A11	7	Outer Plates
1A12	1	End Plate
1A13	1	Plastic Plug
1B	1	Seal, Face (76.97H26, 296.1MM)
1C	2	(LL244510) Brg., Tapered-Cup
1D	2	(LL244549) Brg., Tapered-Cone
1G	1	Housing
1H	1	Pipe Plug, O-Ring (.750-16UNF)
2	1	Spacer, Input
3A	1	Set (Assy.)
3B	5	Brg., Cyl. Roller (F219012)
3C	5	Ret. Ring-Ext. (45MM, D140045)
4	1	O-Ring (-277, 11.484, .139)
5	1	Gear, Ring
6	2	Pin, Dowel (.625, 1.500)
7	2	Bolt, Skt.-Unc. (.500-13, 1.25 L.HD)
8A	1	Carrier (63, 69, 95, 110:1, 2ND STG)
8B	1	Gear, Sun (3RD STG)
8C	1	Ret., Ring-Ext. (2.937, VS293)
8D	3	Gear, Planet
8E	3	Brg., Cyl. Roller (F218973)
8F	3	Ret., Ring-Ext. (35MM, D140035)
9	1	Gear, Sun (63, 69, 95, 110, 2ND STG)
10A	1	Carrier (110:1, 1ST STG, 25T, 3.5)
10B	12	Washer, Thrust (1.118, .060)
10C	57	Brg., Needle (M265, .218, .742)
10D	3	Shaft, Planet
10E	3	Pin, Roll (.1495, 1.00)
10F	3	Gear, Planet (110, 136, 1ST STG)
11	1	Gear, Sun
12	1	Shaft, Input
13	1	Washer, Thrust (3.759, .1245)
14A	1	Gear, Ring/Cover
14B	1	Cover, Cap
14C	4	Bolt, Hex-Unc. (.250-20, .75 GR5)
14D	1	Disengage, Cap
14E	1	Disengage, Rod
14F	1	O-Ring (-112, .478, .103)
14G	1	O-Ring (-131, 1.674, .103)
14H	1	Pipe Plug, Std.-NPTF (.125-27)
15	12	Bolt, Hex-Unc. (.313-18, 1.25GR8)
16	3	Pipe Plug, Std.-NPTF (.250-18)
17	1	Brake, Input (CT-35)
18	2	Screw, Drive (#2, .188)
19	1	Plate, ID
20A	1	Coupling
20B	1	Ret., Ring-Ext. (3.062, 5100-0306)
20C	1	Ret., Ring-Int. (1.062, MNAN0106)
20D	1	Washer, Thrust (.625, .1245)
20E	1	Spring (1.10, 2.000)
20F	2	Ret., Ring-Int. (1.188, NAN118)
21	1	O-ring (-275, 10.484, .139)
22	1	Plug, Plastic (11, .485 O.D.)
25	1	Adaptor, Mounting
26	1	O-Ring (-263, 7.234, .139)
27	4	Bolt, Metric (M12 x 1.75, 35MM)


1A2
1A3
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1A12
3B
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3C
1B
1D
1C
1G
1J
20B
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20F
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10D
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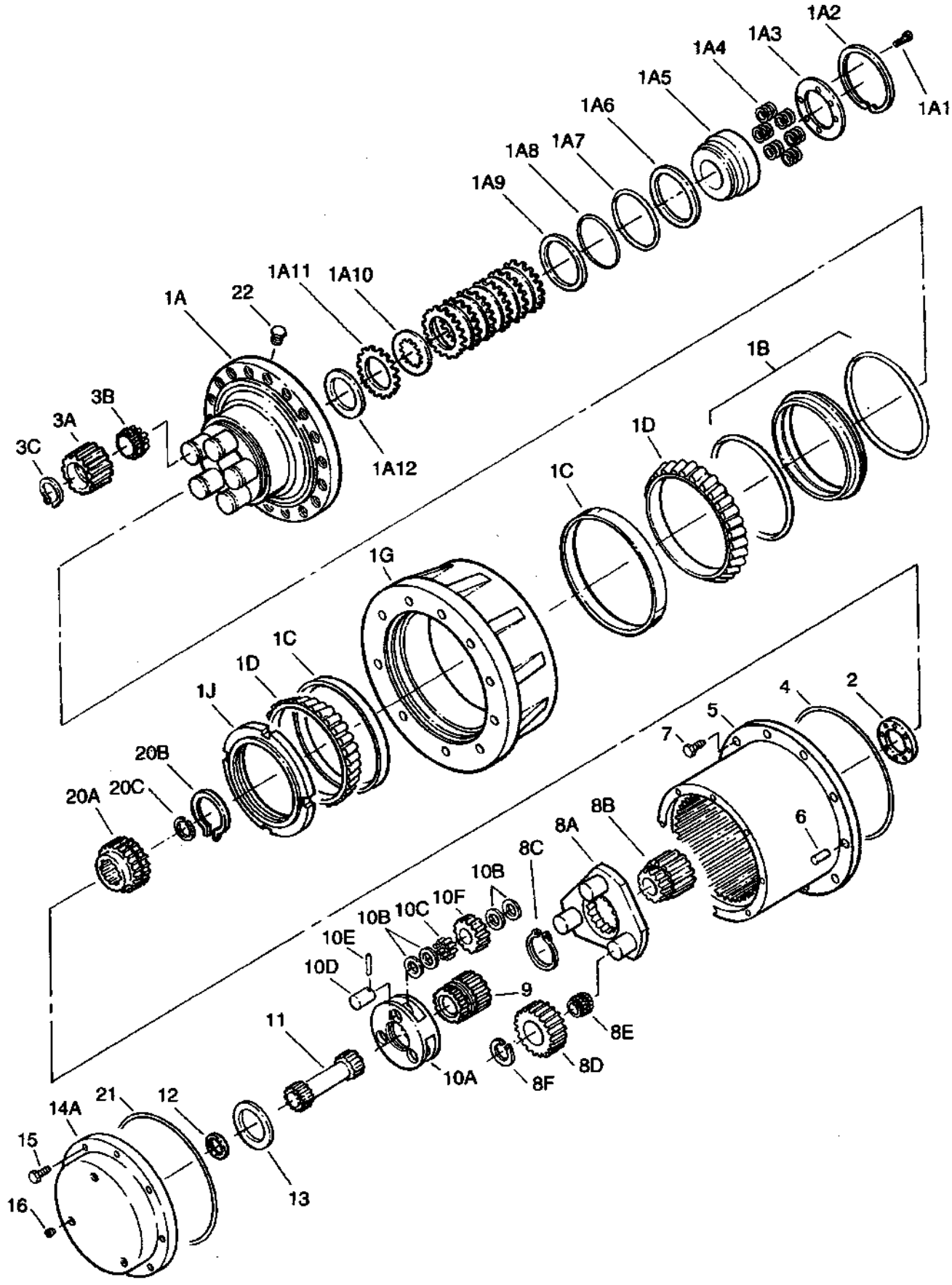
8E
8D
8F
10A
11D
21
14A
15
16
14G
14H
14C
14F
14E
13
14B
14D

Parts List

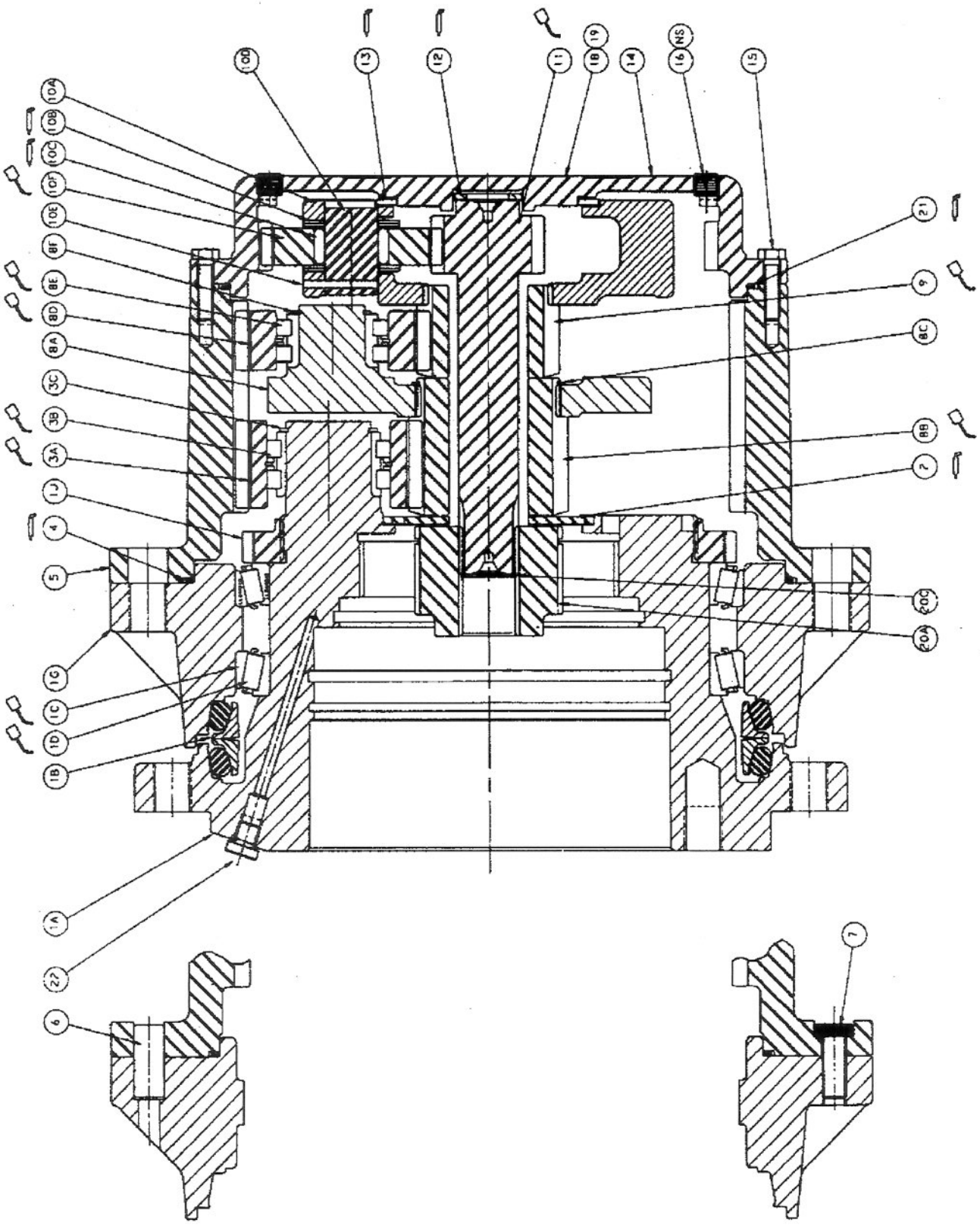
This parts list should be used if your model does not have the Input Disengage feature.

Item	Quantity	Description
1A	1	Spindle
1A1	11	Socket Head Cap Screws
		Input Brake Sub-Assembly
		(consists of items 1A2 through 1A13)
1A2	1	Internal Retaining Ring
1A3	1	Thrust Plate
1A4	6, 9, or 11	Spring
1A5	1	Piston
1A6	1	Dowty Anti-Extrusion Ring
1A7	1	Dowty O-Ring
1A8	1	Dowty O-Ring
1A9	1	Dowty Anti-Extrusion
1A10	6	Inner Plates
1A11	7	Outer Plates
1A12	1	End Plate
1A13	1	Plastic Plug
1B	1	Seal, Face (76.97H26, 296.1MM)
1C	2	(LL244510) Brg., Tapered-Cup
1D	2	(LL244549) Brg., Tapered-Cone
1G	1	Housing
1H	1	Pipe Plug, O-Ring (.750-16UNF)
2	1	Spacer, Thrust
3A	1	Set (Assy.)
3B	5	Brg. Cyl. Roller (F219012)
3C	5	Ret. Ring-Ext. (45MM, D140045)
4	1	O-Ring (-277, 11.484, .139)
5	1	Gear, Ring
6	2	Pin, Dowel (.625, 1.500)
7	2	Bolt, Skt.-Unc. (.500-13, 1.25 L.HD)
8A	1	Carrier (63, 69, 95, 110:1, 2ND STG)
8B	1	Gear, Sun (3RD STG)
8C	1	Ret., Ring-Ext. (2.937, VS293)
8D	3	Gear, Planet
8E	3	Brg., Cyl. Roller (F218973)
8F	3	Ret., Ring-Ext. (35MM, D140035)

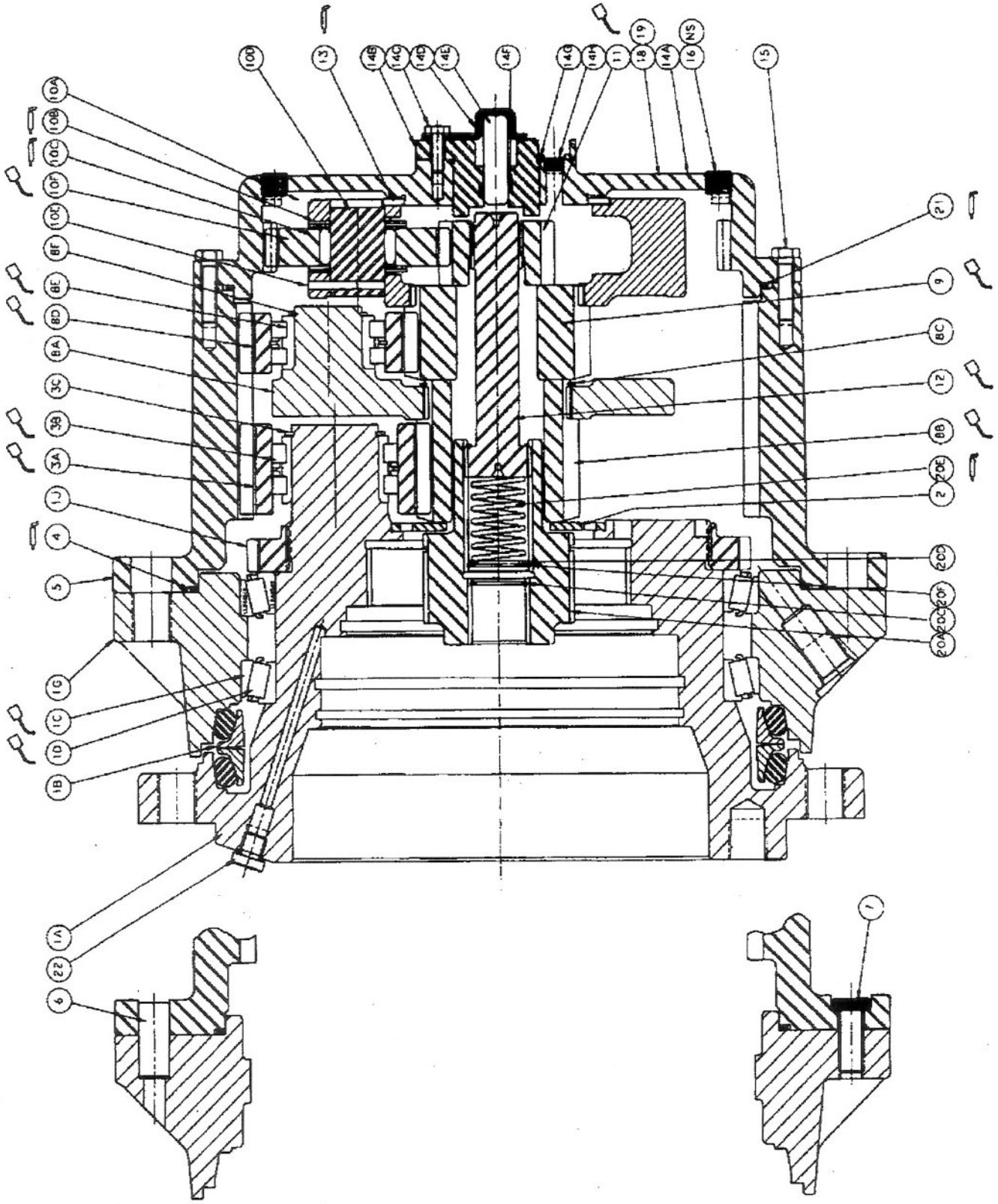
Item	Quantity	Description
9	1	Gear, Sun (63, 69, 95, 110, 2ND STG)
10A	1	Carrier (110:1, 1ST STG, 25T, 3.5)
10B	12	Washer, Thrust (1.118, .060)
10C	57	Brg., Needle (M265, .218, .742)
10D	3	Shaft, Planet
10E	3	Pin, Roll (.1495, 1.00)
10F	3	Gear, Planet (110, 136, 1ST STG)
11	1	Gear, Sun
12	1	Washer, Thrust (.882, .1245)
13	1	Washer, Thrust (3.759, .1245)
14	1	Gear, Ring/Cover
15	12	Bolt, Hex-Unc. (.313-18, 1.25GR8)
16	3	Pipe Plug, Std.-NPTF (.250-18)
17	1	Brake, Input (CT-35)
18	2	Screw, Drive (#2, .188)
19	1	Plate, ID
20A	1	Coupling
20B	1	Ret., Ring-Ext. (3.062, 5100-0306)
20C	1	Ret., Ring-Int. (1.062, MNAN0106)
21	1	O-ring (-275, 10.484, .139)
22	1	Plug, Plastic (11, .485 O.D.)
25	1	Adaptor, Mounting
26	1	O-Ring (-263, 7.234, .139)
27	4	Bolt, Metric (M12 x 1.75, 35MM)


1A2
1A3
1A4
1A5
1A6
1A7
1A8
1A9
1A1
1A11
1A10
1A
22
1A12
1B
3B
3A
3C
1D
1C
1G
1C
1D
1J
20B
20C
20A
4
2
5
7
6
8B
8A
8C
10B
10F
10C
10B
10E
10D
9
8E
8D
8F
10A
11
21
12
14A
15
16
13

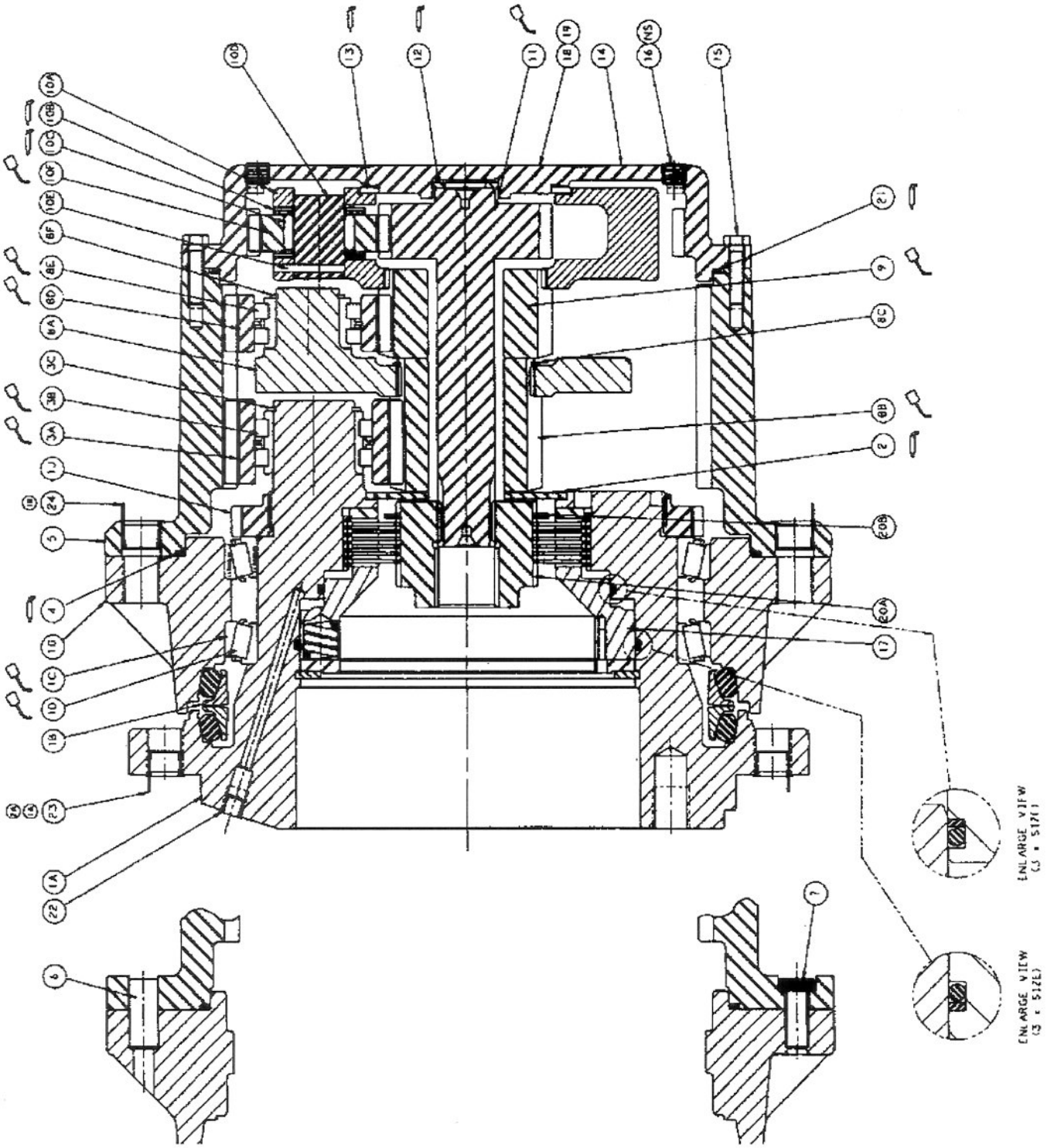
Non-Disengage with No Brake



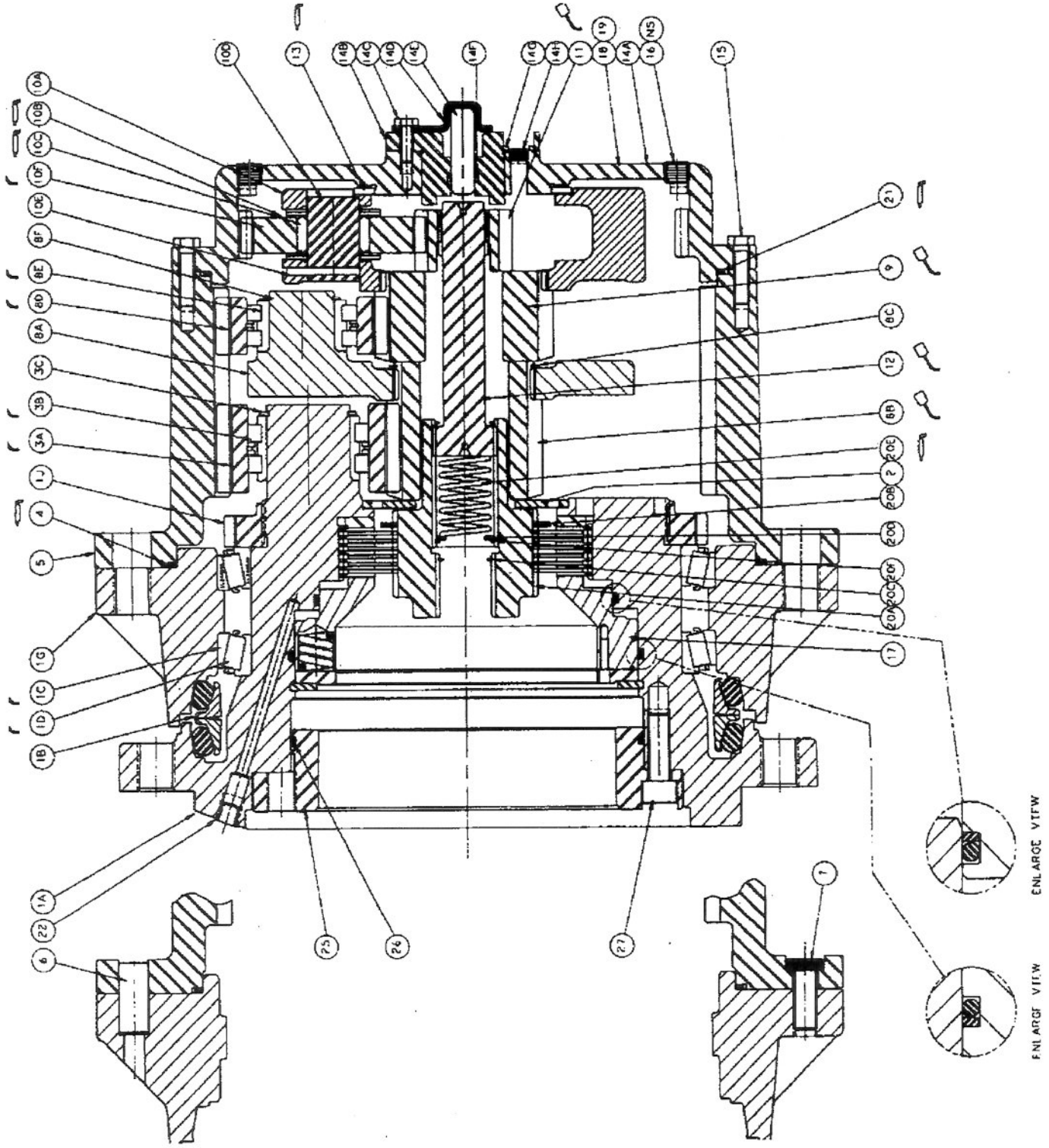
Disengage with No Brake



Non-Disengage with Brake



Disengage with Brake



Lubrication Specification

The lubricant should be petroleum based, non-detergent gear fluid containing anti-oxidation, anti-foaming and extreme pressure additives. The lubricant should have a minimum viscosity index of 95 and maintain a minimum viscosity of 40 cst under normal operating temperature conditions for the torques and speeds required.

The following table lists the recommended viscosities for various ambient operating temperatures. These recommendations are based on a temperature rise of 50 to 100°F at normal operating conditions.

	Differential Planetaries		Simple Planetaries	
Ambient Temperatures	ISO Index	AGMA Lubricant No.	ISO Index	AGMA Lubricant No.
-40° to -5°F (1)	VG100	3EP	VG100	3EP
-5° to 40°F	VG150	4EP	VG100	3EP
40° to 105°F	VG220/VG320	5EP/6EP	VG150/VG220	4EP/5EP
105° to 150°F (2)	VG460	7EP	VG320	6EP

For special applications, high horsepowers, high speeds or wide temperature changes consult Fairfield Manufacturing.

Oil quantities for each series of reducers are indicated in the appropriate series brochure. An initial oil change should be made after the first 50 hours of operation. Subsequent oil changes should be made at 1000 hour intervals or annually, whichever occurs more frequently. Oil should be drained while hot in order to reduce sludge deposits. It is recommended that the unit be flushed with a flushing fluid compatible with the lubricant used.

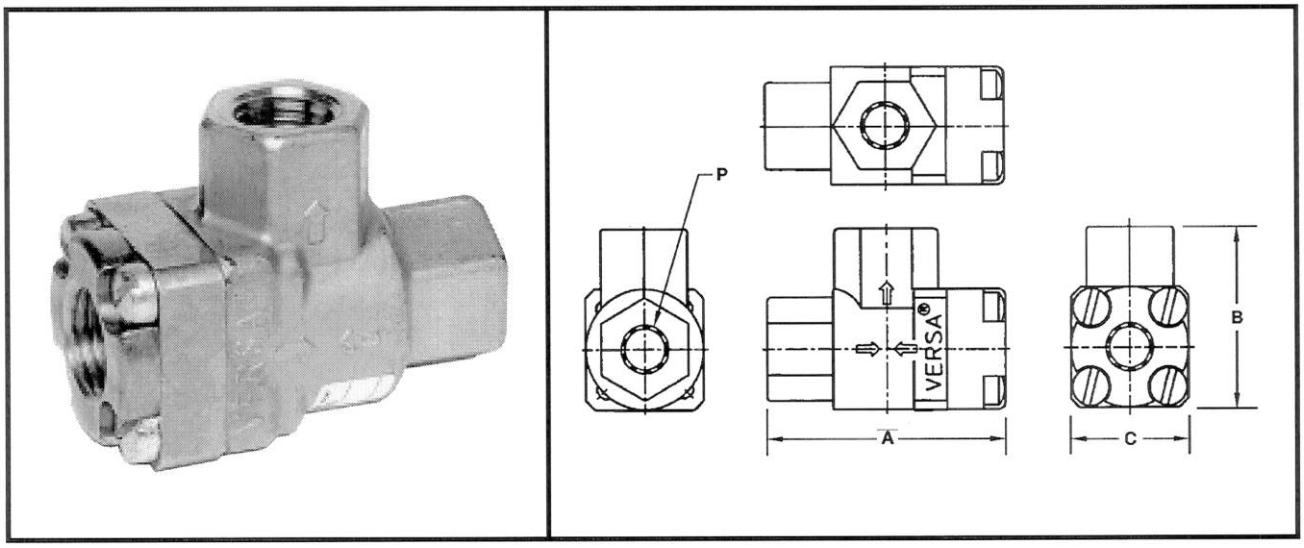
1. For operation in this ambient temperature range a synthetic oil or multi-grade oil is recommended with a pour point of 10°F lower than the minimum ambient temperature.

2. For operation in this ambient temperature range a synthetic oil is recommended for proper lubrication life at elevated temperatures.

Component Data Sheets

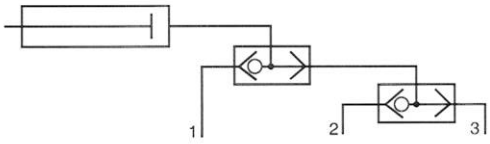
RAM P/N AG03318

SHUTTLE VALVES



General Description

Shuttle Valves are constructed of solid Brass or 316 Stainless Steel, with resilient seals providing tight shut off. Shuttle valves are 3/2 valves, primarily used to charge and discharge a pressure line or chamber from two - or more - sources. A typical schematic is shown below:



Materials

Type:	Brass	Stainless Steel
Body:	Brass	316 Stainless Steel†
Shuttle:	Nylon(Zytel)	316 Stainless Steel†
Seals:	NBR (Nitrile)	FKM (Fluorocarbon)
Screws:	Plated Steel	316 Stainless Steel†

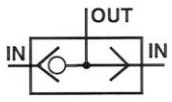
Functional Description

Shuttle Valves have a free moving shuttle that blocks one of two inlet ports while the other inlet port is connected to the (common) outlet port. When a pressure signal enters the port blocked by the shuttle, it will cause the shuttle to shift over to close the opposite inlet port. The shuttle will stay there while the line or chamber connected to the outlet port is charged and/or discharged and will only shift when pressure is applied to the inlet port it is blocking at that time.
In logic terms a shuttle valve is an 'OR' - function.

Pressures

Pressure range– Pneumatic: 5 to 200 psi (0.35 to 14 bar)
Hydraulic: 5 to 500 psi (0.35 to 35 bar)

Symbol



Mounting

Preferably with the centerline of the two inlet ports horizontal. As shown in the drawing above.

Sizes/Connections/Types/Dimensions/Weights

*Porting	Product Number		Dimensions in inch (mm)			Flow Cv (Kv)		Weights in lbs (kg)	
'P'	brass	st. steel	'A'	'B'	'C'	brass	st. steel	brass	st. steel
1/8 NPT	**SV-2**		2.0 (51)	1.5 (38)	1.0 (25)	0.8 (12)		0.57 (0.26)	
1/4 NPT	**SV-3**	**SV-3-316**	2.0 (51)	1.5 (38)	1.0 (25)	0.8 (12)	0.5 (7)	0.57 (0.26)	0.33 (0.15)
3/8 NPT	**SV-4**		2.5 (64)	1.9 (48)	1.3 (32)	1.6 (23)		1.10 (0.50)	
1/2 NPT	**SV-5**		2.5 (64)	1.9 (48)	1.3 (32)	2.1 (30)		1.10 (0.50)	
3/4 NPT	**SV-6**		3.5 (89)	2.8 (70)	1.5 (38)	6.5 (84)		2.16 (0.98)	

RAM P/N AG70252

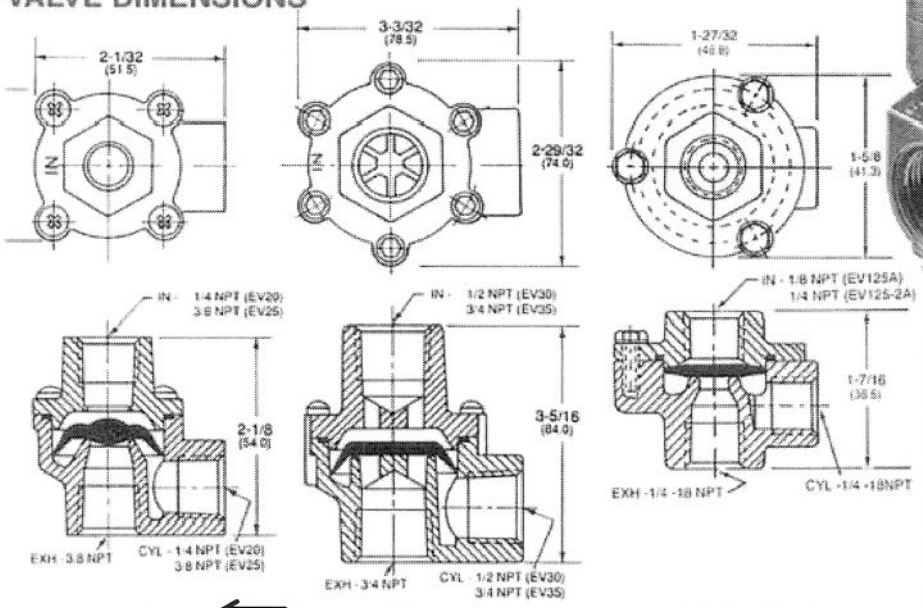
QUICK EXHAUST VALVES

- **Instantaneous dumping of air allows use of smaller valves and piping**
- **Increases system efficiency and speeds**

Quick Exhaust Valves provide fast dumping of exhaust air at the cylinder, eliminating the need for large selector valves ordinarily required to accommodate exhaust air moving back through the pneumatic system. Substantial front end savings and better operating efficiency result from the use of smaller air system components. In addition, smoother, faster cylinder operation and wider application of air-powered motions are obtained.

The Quick Exhaust Valve has been designed with smooth, over-size internal passages which afford unrestricted flow and prevent clogging due to contaminated air lines. The diaphragm is also an exclusive Deltrol design, and it assures instantaneous and complete venting of exhaust air from cylinders, air presses and other air-operated equipment.

VALVE DIMENSIONS

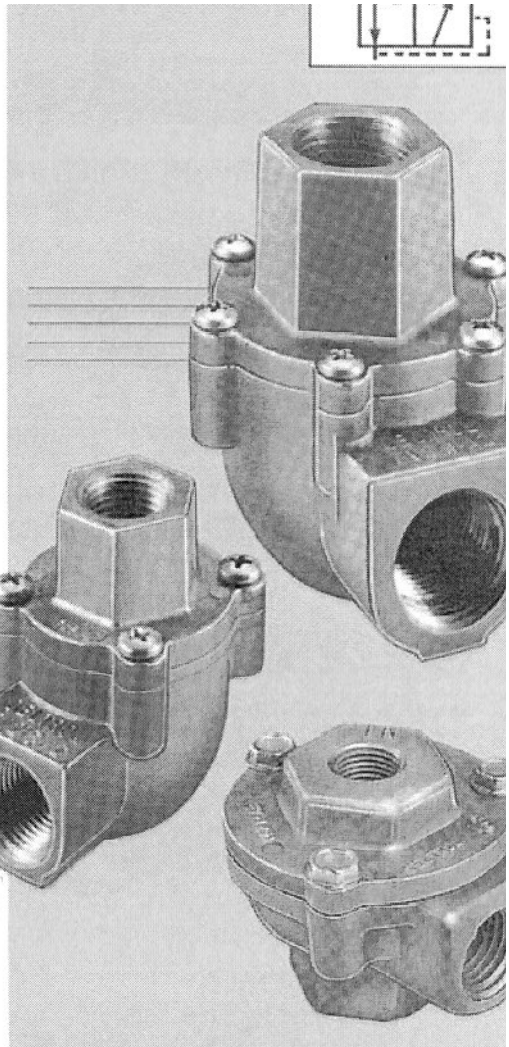


EV20-EV25 ← **EV30-EV35** **EV125-EV125-2**

BODY – DIE CAST ALUMINUM

Model Number	Inlet Port	Inlet Cv	Cylinder Port	Exhaust Port	Exhaust Cv	Min. ΔP to Shift Diaphram
EV125A	1/8"	.50	1/4"	1/4"	1.0	5 PSI (.3 Bar)
EV125A2	1/4"	.50	1/4"	1/4"	1.0	5 PSI (.3 Bar)
EV20A2	1/4"	1.57	1/4"	3/8"	2.33	8 PSI (.5 Bar)
EV20A2V	1/4"	1.57	1/4"	3/8"	2.33	8 PSI (.5 Bar)
→ EV25A2	3/8"	2.50	3/8"	3/8"	2.98	8 PSI (.5 Bar)
EV25A2V	3/8"	2.50	3/8"	3/8"	2.98	8 PSI (.5 Bar)
EV30A2	1/2"	3.48	1/2"	3/4"	5.45	3 PSI (.2 Bar)
EV30A2V	1/2"	3.48	1/2"	3/4"	5.45	3 PSI (.2 Bar)
EV35A2	3/4"	5.32	3/4"	3/4"	7.84	3 PSI (.2 Bar)
EV35A2V	3/4"	5.32	3/4"	3/4"	7.84	3 PSI (.2 Bar)

OPERATING PRESS: 20 - 125 PSI (1.4 - 8.6 BAR)
OPERATING TEMP: STD. BUNA-N: 0 - 240 DEGREES F
VITON*: 0 - 400 DEGREES F
*INDICATED BY "V" AT END OF MODEL NUMBER



EV20A2, EV25A2, EV30A2 & EV35A2

PRINCIPLE OF OPERATION

FIGURE A

When air is introduced into the inlet port, the diaphragm is forced onto the exhaust seat. The outer lip of the diaphragm is deflected downward, away from the wall, allowing air to flow into the cylinder with a minimum of restriction. The diaphragm will remain on the exhaust seat as long as the inlet pressure is equal to or greater than the cylinder pressure.

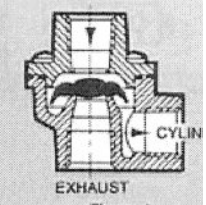


Figure A

FIGURE B

When the cylinder is fully charged and air is no longer flowing from inlet to cylinder port, the outer lip of the diaphragm will assume its normal shape and will contact the outer wall. The diaphragm will remain on the exhaust seat.

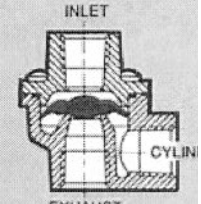


Figure B

FIGURE C

When pressure at the inlet port is vented to atmosphere (thru the control valve) the air in the cylinder, which is at a pressure level higher than atmosphere will force the diaphragm upwards to the inlet port. This will shut off the inlet port and allow air in the cylinder to flow directly to atmosphere.

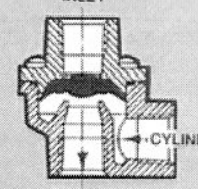
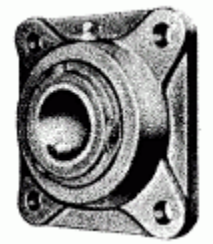


Figure C

RAM P/N AG48047

4-Bolt Flange Bearing



Description and Dimensions

RAM P/N AG48047

4 Bolt Flange Bearing

INSTALLATION INSTRUCTIONS

WARNING

TO ENSURE THAT DRIVE IS NOT UNEXPECTEDLY STARTED, TURN OFF AND LOCK OUT OR TAG POWER SOURCE BEFORE PROCEEDING. FAILURE TO OBSERVE THESE PRECAUTIONS MAY RESULT IN BODILY INJURY.

NON-EXPANSION BEARING

1. Clean shaft and bore of bearing. The shaft should be straight, free of burrs and nicks, and correct size (see shaft tolerance table). If used shafting is utilized, then the bearing should be mounted on unworn section of shafting.
2. Lubricate shaft and bearing bore with grease or light oil to facilitate assembly. Slip bearing into position. When light press fit is required, press against the end of the inner ring of bearing. Do not strike or exert pressure on the housing or seals.
3. Mount bearing to support, using shims where necessary to align bearing so inner ring does not rub on seal metal shield. Use full shims which extend across the entire housing base.
4. Determine final shaft position and tighten setscrews in the locking collar of non-expansion bearing to recommended torque while the other bearings remain free.
5. For normal thrust loads, shock loads, or vibration, the shaft should be spot milled to provide additional holding power. Under heavy thrust load applications it is advisable to use auxiliary thrust carrying devices such as shaft shoulder, snap rings, or a thrust collar.

EXPANSION BEARING

Steps (1,2,3) Same as Non-Expansion Bearing.

4. Position expansion bearing in the housing. For normal expansion conditions, the bearing insert should be positioned in the center of the housing. To center bearing insert in housing, move bearing insert to extreme position and mark shaft. Then using bearing maximum total expansion table, move bearing insert in opposite direction one-half the total expansion to center bearing in the housing. If maximum expansion is required, move bearing insert to the extreme position in the housing to permit full movement in direction of expansion. After expansion bearing has been positioned in the housing, tighten the setscrews in the locking collar to the recommended torque.

SHAFT AND BEARING ASSEMBLY

1. Manually rotate shaft before and after tightening mounting bolts. Torque required to rotate should be the same. If there is any strain, irregular rotational torque or vibration, it could be due to incorrect alignment, bent shaft or bent supports. Installation should be rechecked and correction made where necessary.

FIELD CONVERSION (RE-OP) OF A NON-EXPANSION BEARING INTO AN EXPANSION BEARING

All bearings sizes can be re-oped to become an expansion bearing. To re-op a non-expansion to an expansion bearing remove snap ring from the side opposite collar and also remove the non-expansion spacer and discard. Re-install snap ring.

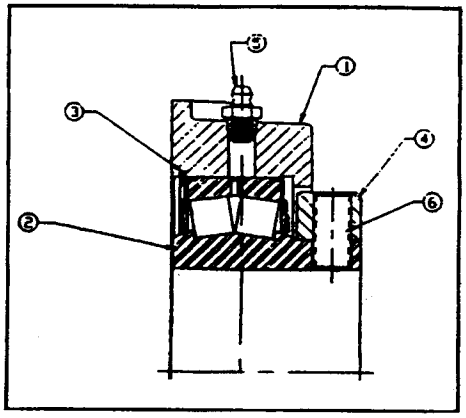
BEARING MAXIMUM TOTAL EXPANSION TABLE

SHAFT SIZE		TOTAL EXPANSION
In.	MM	In.
$1^{7}/_{16}$ - $2^{3}/_{16}$	40, 45, 50	$^{5}/_{32}$
$2^{7}/_{16}$ - $3^{7}/_{16}$	55 - 90	$^{3}/_{16}$
$3^{15}/_{16}$ - 4	—	$^{7}/_{32}$

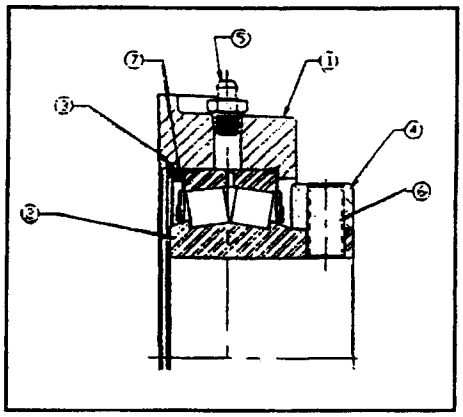
WARNING: Because of the possible danger to persons(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed: Products must be used in accordance with the engineering information specified in the catalog. Proper installation, maintenance and operation procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Rockwell Automation nor are the responsibility of Rockwell Automation. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a holding device must be an integral part of the driven equipment beyond the speed reducer output shaft.

RAM P/N AG48047

4 Bolt Flange Bearing



FLANGES
SIZES 1 7/16" - 4"
NON-EXPANSION



FLANGES
SIZES 1 7/16" - 4"
EXPANSION

ITEM	HOUSINGS		2*	3	4	5	6	7
SHAFT SIZE, INS.	2-BOLT PILLOW BLOCK	4-BOLT FLANGE	BEARING	SNAP RING	COLLAR	GREASE FITTING	SETSCREW	SPACER
1 7/16	048068	048084	421243	044583	040050	405015	400058	048359
1 1/2	048068	048084	421244	044583	040050	405015	400058	048359
1 11/16	048070	048086	421245	044584	040051	405015	400058	048360
1 3/4	048070	048086	421246	044584	040051	405015	400058	048360
1 15/16	048072	048088	421247	044585	040052	405015	400094	048361
2	048072	048088	421248	044585	040052	405015	400094	048361
2 3/16	048074	048090	421249	044586	040053	405015	400094	048362
2 7/16	048076	048092	421250	044587	040054	405015	400094	048363
2 1/2	048076	048092	421251	044587	040054	405015	400094	048363
2 11/16	048078	048094	421252	044588	040055	405015	400150	048364
2 3/4	048078	048094	421253	044588	040055	405015	400150	048364
2 15/16	048078	048094	421254	044588	040055	405015	400150	048364
3	048078	048094	421255	04~1588	040055	405015	400150	048364
3 7/16	048080	048096	421256	044589	040056	405015	400154	048365
3 1/2	048080	048096	421257	044589	040056	405015	400154	048365
3 15/16	048082	048098	421258	421162	040057	405015	400190	048366
4	048082	048098	421259	421162	040057	405015	400190	048366
QTY/PER	1	1	1	1	1	1	2	1

*SEALS ARE AN INTEGRAL PART OF THE BEARING INSERT.

LUBRICATION INSTRUCTIONS

OPERATION IN PRESENCE OF DUST, WATER OR CORROSION VAPORS

This bearing is factory lubricated with No. 2 consistency lithium-base grease which is suitable for most applications. However, extra protection is necessary if bearing is subjected to excessive moisture, dust, or corrosive vapor. In these cases, bearing should contain as much grease as speed will permit (a full bearing with consequent slight leakage through the seal is the best protection against contaminant entry).

In extremely dirty environments, the bearing should be purged daily to flush out contaminants. For added protection, it is advisable to shroud the bearing from falling material.

HIGH SPEED OPERATION

At higher operating speeds, too much grease may cause overheating. In these cases, the amount of lubrication can only be determined by experience. If excess grease causes overheating, remove grease fittings and run for ten minutes. This will allow excess grease to escape. Then wipe off excess grease and replace grease fittings.

In higher speed applications, a small amount of grease at frequent intervals is preferable to a large amount at infrequent intervals. However, the proper volume and interval of lubrication can best be determined by experience.

AVERAGE OPERATIONS

The following table is a general guide for normal operation conditions. However, some situations may require a change in lubricating periods as dictated by experience. If the bearing is exposed to unusual operating conditions, consult a reputable grease manufacturer.

LUBRICATION GUIDE

Read Preceding Paragraphs Before Establishing Lubrication Schedule.

Suggested Lubrication Period in Weeks								
Hours run per day	1 to 250 rpm	251 to 500 rpm	501 to 750 rpm	751 to 1000 rpm	1001 to 1500 rpm	1501 to 2000 rpm	2001 to 2500 rpm	2501 to 3000 rpm
8	12	12	10	7	5	4	3	2
16	12	7	5	4	2	2	2	1
24	10	5	3	2	1	1	1	1

SET SCREW TORQUE TABLE

SHAFT SIZE	SOCKET SET SCREW SIZE	TIGHTENING TORQUE
1 7/16 - 1 3/4 Inches	5/16 Inches	165 Inch-Pounds
1 7/8 - 2 1/2 Inches	3/8 Inches	290 Inch-Pounds
2 11/16 - 3 1/2 Inches	1/2 Inches	620 Inch-Pounds
3 11/16 - 5 Inches	5/8 Inches	1325 Inch-Pounds
40 - 45 mm	M8	17.8 Newton-meters
50 - 65 mm	M10	35 Newton-meters
70 - 90 mm	M12	57 Newton-meters

OPERATION TEMPERATURES

Abnormal bearing temperatures may indicate insufficient lubrication. If the housing is too hot to touch for more than a few seconds, check the temperature by applying a thermometer at the top of the pillow block with the thermometer top surrounded by putty.

Because the thermometer reading will be approximately 10°F lower than the actual bearing temperature, add ten degrees to the reading and compare to the temperature rating of your grease. If the bearing temperature reading is consistent and operating within the recommended limits of your grease, the bearing is operating satisfactorily.

The recommended maximum operating temperature for No. 2 lithium base grease is 200°F.

STORAGE OR SPECIAL SHUT DOWN

If equipment will be idle for some time, before shutting down, add grease to the bearing until grease purges from the seals. This will ensure protection of the bearing, particularly when exposed to severe environmental conditions. After storage or idle period, add fresh grease to the bearing before starting.

RECOMMENDED SHAFT TOLERANCE TABLE

NOMINAL SHAFT SIZE	LOW TO NORMAL EQUIVALENT LOADS AND CATALOG SPEED *	
Up to 1 1/2 Inches	+.000 Inches	−.0005 Inches
Over 1 1/2 to 2 1/2 Inches	+.000 Inches	−.001 Inches
Over 2 1/2 to 4 Inches	+.000 Inches	−.001 Inches
40 - 90 mm	+.000 mm	−.025 mm

On severe applications and where dynamic balance and minimum runout are important, a snug to light press fit may be required to obtain optimum bearing performance. Consult factory.

* Normal equivalent load .08 x c to .18 x c

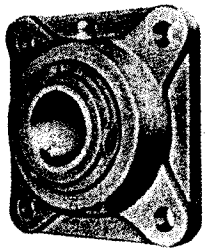
Mounting Bolt Information

Inch

Bearing Bore Size (In.)	Pillow Block				4-Bolt Flange			
	Bolt Size	Bolt Qty.	Bolt Torque (ft-lb) Grade 2	Bolt Torque (ft-lb) Grade 5	Bolt Size	Bolt Qty.	Bolt Torque (ft-lb) Grade 2	Bolt Torque (ft-lb) Grade 5
1 7/16 - 1 1/2	1/2 - 13	2	50	75	1/2 - 13	4	50	75
1 11/16 - 1 3/4	1/2 - 13	2	50	75	1/2 -13	4	50	75
1 15/16 -2	5/8 -11	2	100	150	1/2 -13	4	50	75
2 3/16	5/8 - 11	2	100	150	5/8 - 11	4	100	150
2 7/16 - 2 1/2	5/8 -11	2	100	150	5/8 - 11	4	100	150
2 11/16 - 3	3/4 - 10	2	175	260	3/4 - 10	4	175	260
3 7/16 - 3 1/2	7/8 - 9	2	170	430	3/4 - 10	4	175	260
3 15/16 - 4"	1 - 8	2	250	640	7/8 - 9	4	170	430

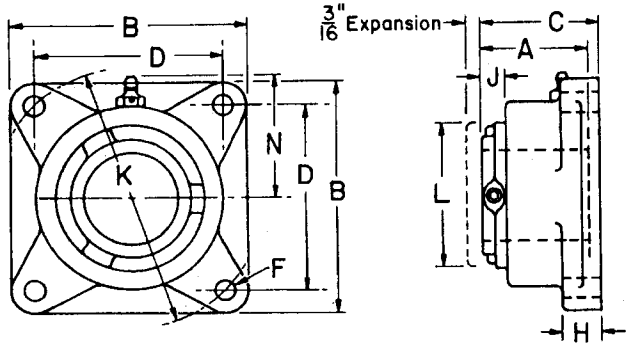
Metric

Bearing Bore Size (mm)	Pillow Block					4-Bolt Flange			
	Bolt Size	Bolt Qty.	Bolt Torque (N-m) Grade 5.8	Bolt Torque (N-m) Grade 8.8	Bolt Size	Bolt Qty.	Bolt Torque (N-m) Grade 5.8	Bolt Torque (N-m) Grade 8.8
40, 45	12 * 1.75	2	47-50	83-89	12 * 1.75	4	47-50	83-89
50	16 * 2	2	115-124	200-215	12 * 1.75	4	47-50	83-89
55	16 * 2	2	115-124	200-215	16 * 2	4	115-124	200-215
60, 65	16 * 2	2	115-124	200-215	16 * 2	4	115-124	200-215
70, 75	20 * 2.5	2	219-238	390-420	20 * 2.5	4	219-238	390-420
80, 85, 90	22 * 2.5	2	298-322	530-570	20 * 2.5	4	219-238	390-420



RAM P/N AG48047

4 - Bolt Flange Bearing Dimensions



4-Bolt Flange Bearings (non-expansion/expansion types)

Shaft Size ▲	Non-Expansion Type* Part No.	Wt.	Expansion Type Part No.	Wt.	A	B	C	D	F Bolt Dia.	H	J	K	L	N
1 7/16 1 1/2	041350 041352	5.0 4.9	041351 041353	6.0 5.9	1 43/64	4 3/4	1 29/32	3 17/32	1/2	3/4	9/16	5	2 3/4	2 7/16
1 11/16 1 3/4	041354 041356	6.5 6.4	041355 041357	7.5 7.4	1 57/64	5 1/8	2 5/32	3 29/32	1/2	3/4	23/32	5 1/2	3 3/16	2 3/4
1 15/16 2	041358 041360	6.8 6.7	041359 041361	7.8 7.7	1 57/64	5 5/16	2 11/64	4 1/16	1/2	3/4	23/32	5 3/4	3 7/16	2 7/8
2 3/16	041362	8.5	041363	9.5	1 31/32	5 7/8	2 17/64	4 1/2	5/8	3/4	11/16	6 3/8	3 3/4	3 1/16
2 7/16 2 1/2	041364 041366	10.8 10.7	041365 041367	11.8 11.7	2 3/32	6 1/8	2 11/32	4 25/32	5/8	15/16	5/8	6 3/4	4 1/16	3 3/8
2 11/16 2 3/4 2 15/16 3	041368 041378† 041370 041372	16.1 16.0 15.2 15.0	041369 041379† 041371 041373	18.1 18.0 17.2 17.0	2 19/64	7 3/16	2 19/32	5 9/16	3/4	15/16	25/32	7 7/8	4 23/32	3 13/16
→ 3 7/16 3 1/2	041374 041380†	24.9 24.6	041375 041381†	27.9 27.6	2 45/64	8 11/32	3 1/64	6 23/32	3/4	1 1/8	27/32	9 1/2	5 7/16	4 9/16 ←
3 15/16 4	041376 041382†	32.8 32.5	041377 041383†	35.8 35.5	3 3/32	9 15/32	3 7/16	7 5/8	7/8	1 1/8	15/16	10 3/4	5 15/16	4 11/16

RAM P/N LB90089

2” Filter

Specifications and Dimensions

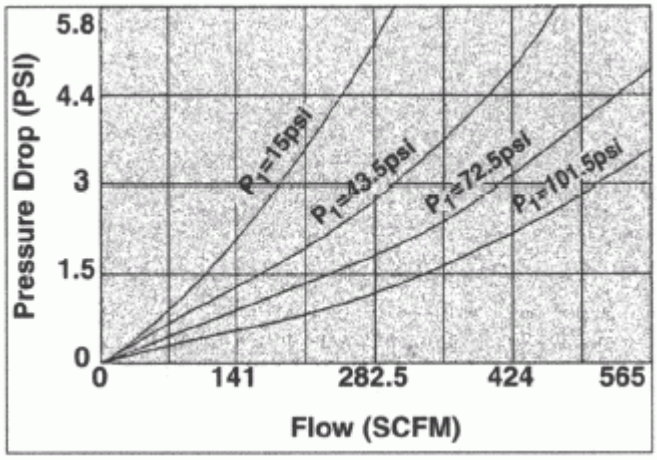
RAM P/N LB90089

FILTER

Specifications

Pipe Size	2
Net Bowl Capacity oz. (cm^3)	6.1 (180)
Weight lbs. (kgf)	6.94 (3.15)
Proof Pressure psig (Mpa)	220 (1.5)
Max. Operating Pressure psig (Mpa)	150 (1.0)
Operating Temperature Range	23° ~ 140° F (-5° ~ 60° C)
Filtration	40 μm

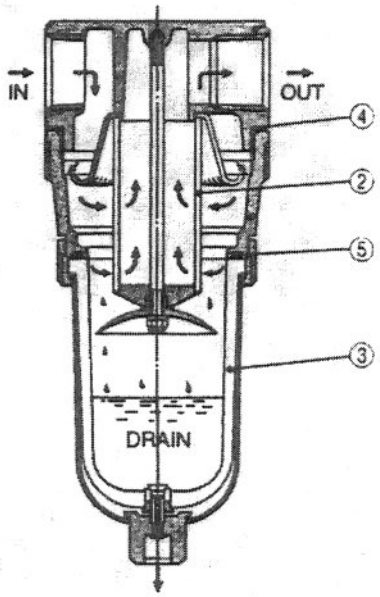
Flow Characteristics



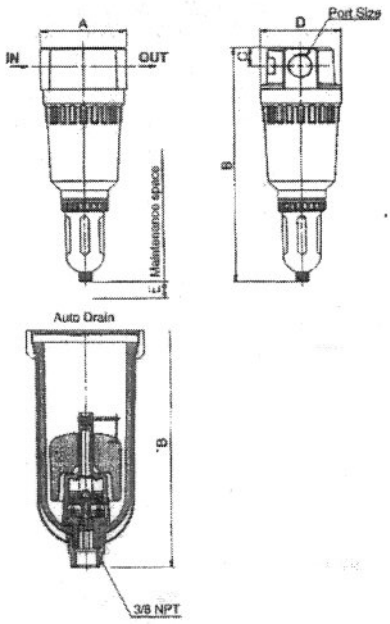
RAM P/N LB90089
FILTER

Construction/Parts List

Item No.	Name	Material
●	Filter Element	Bronze
●	Bowl and guard	SPC
●	Housing O-ring	NBR
●	Bowl O-ring	
—	Repair Kit	—

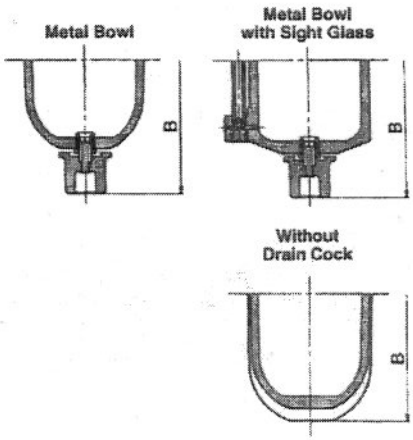


Dimensions



A	B	B	C	D	E	Port size
7.87	19.29	20.43 (519)	1.81	6.69 (170)	10.24 (260)	2

Dimensions with options



B		
Metal Bowl	Metal Bowl w/sight glass	w/o Drain Cock
19.25 (489)	20.49 (520.5)	18.64 (473.5)

RAM P/N AG00212
BACKPRESSURE REGULATOR

OPERATION:

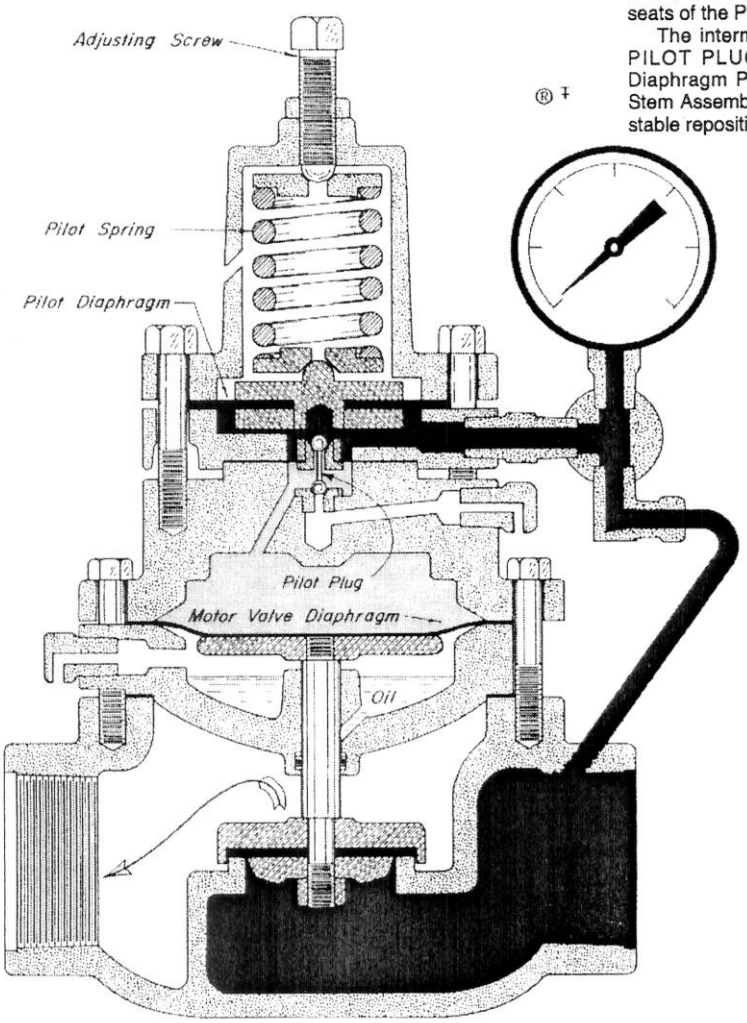
The Pilot Assembly and Motor Valve Stem Assembly (Crosshatched) are the only moving units in the regulator. The PILOT PLUG consists of two stainless balls rigidly connected together. The upper seat for the PILOT PLUG is the Motor Valve Diaphragm Pressure inlet (Red to Yellow). The lower seat for the PILOT PLUG is the pressure vent (Yellow to Atmosphere).

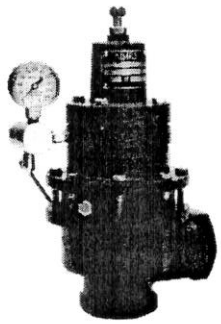
The PILOT SPRING in the bonnet loads the upper side of the Pilot Assembly and is opposed on the underside by Upstream Pressure (Red).

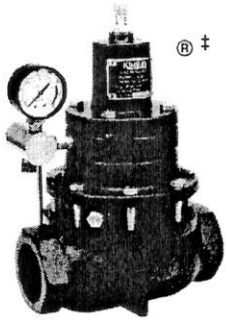
Assume the PILOT SPRING is compressed with the ADJUSTING SCREW for a set pressure greater than the Upstream Pressure (Red). The Pilot Assembly is forced downward by the PILOT SPRING. The lower seat for the PILOT PLUG (Yellow to Atmosphere) is closed and the upper seat for the PILOT PLUG (Red to Yellow) is open. This lets full Upstream Pressure (Red) load the motor valve. The area of the MOTOR VALVE DIAPHRAGM is twice the area of the motor valve seat, assuring a positive shut-off.

As the Upstream Pressure (Red) increases to the set pressure, the Pilot Assembly moves upward against the PILOT SPRING to first close the upper seat (Red to Yellow) and open the pressure vent (Yellow to Atmosphere). As the Motor Valve Diaphragm Pressure (Yellow) is decreased, the Upstream Pressure (Red) acting under the motor valve seat, opens the valve. With relief of Upstream Pressure (Red) through the motor valve, the Pilot Assembly assumes a position in which both seats of the PILOT PLUG are closed.

The intermittent bleed pilot, three-way valve action of the PILOT PLUG against its seat adjusts the Motor Valve Diaphragm Pressure (Yellow), repositioning the Motor Valve Stem Assembly to accommodate any rate of flow. The rapid but stable repositioning produces a true throttling action.

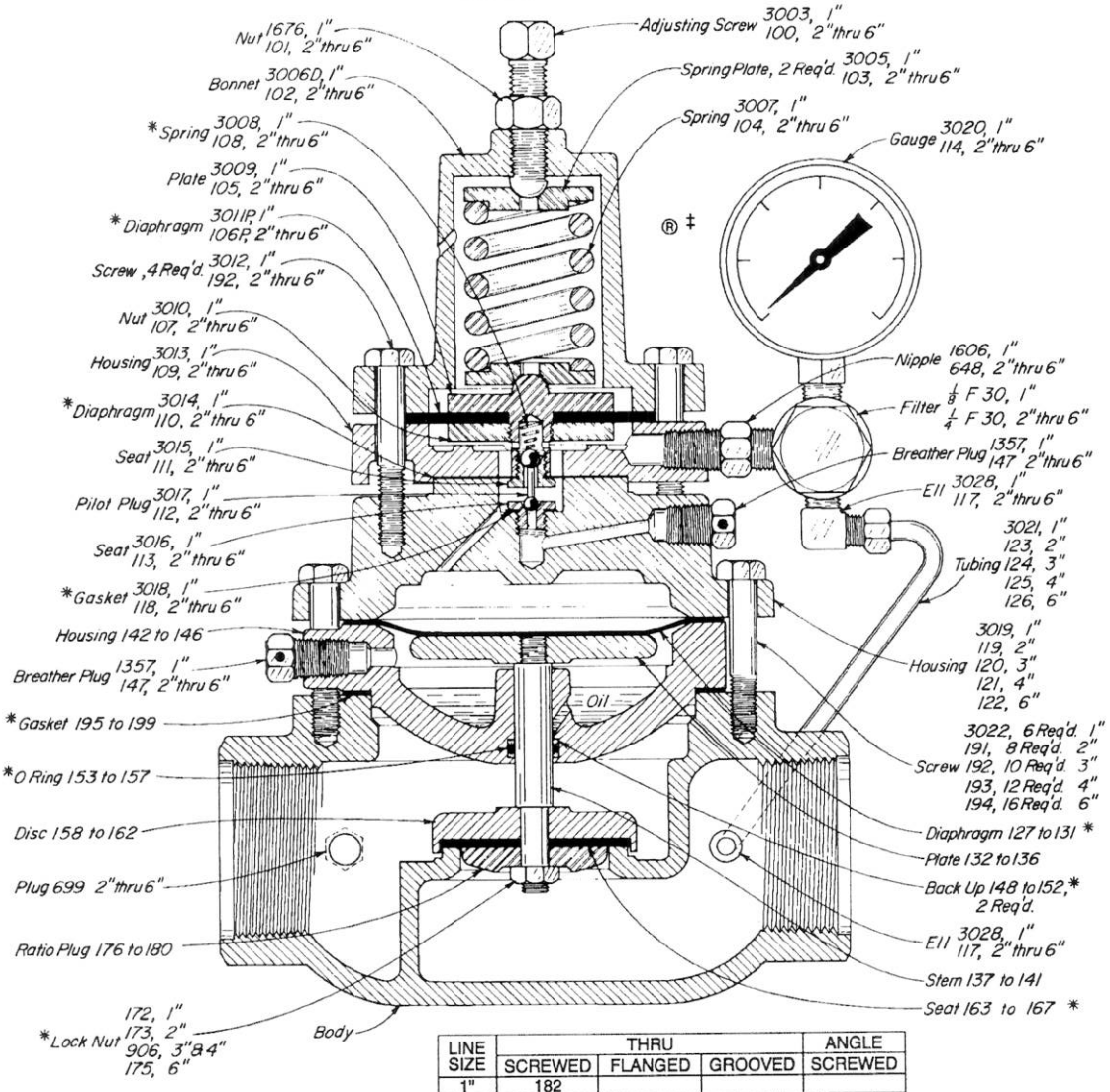






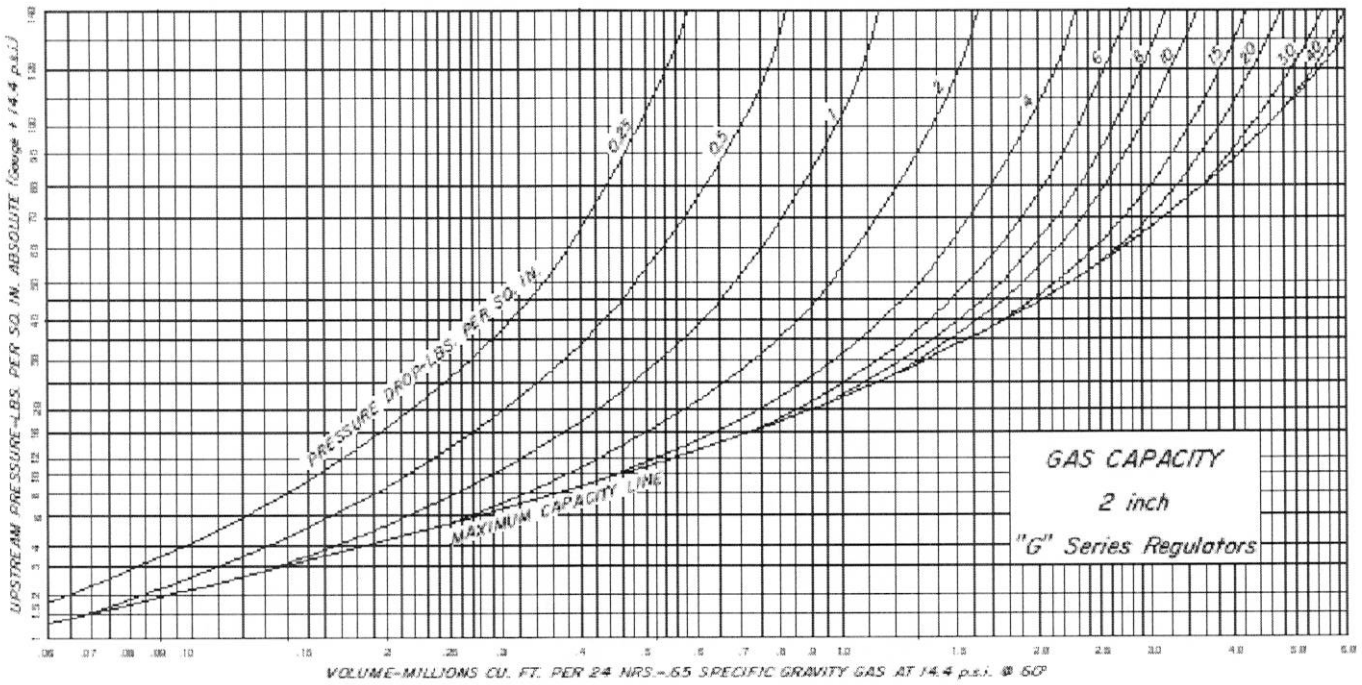
RAM P/N AG00212
BACKPRESSURE REGULATOR

1", 2", 3", 4" & 6" S/F/GGT/A BP
CAST IRON
125 lbs. W.P.

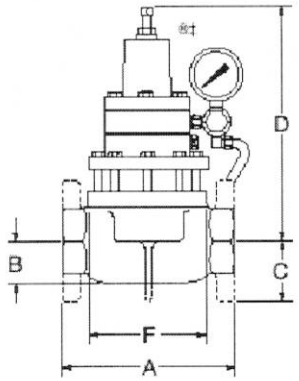


LINE SIZE	THRU			ANGLE
	SCREWED	FLANGED	GROOVED	SCREWED
1"	182			
2"	183	184	1500	4949
3"	185	186		
4"	187	188		
6"		189		

RAM P/N AG00212
BACK PRESSURE REGULATOR
Specifications and Dimensions



CAST IRON OR DUCTILE



LINE SIZE	BODY STYLE	A	B	C	D*	E	F	G	H*	I
1 "	SCRD	4 3/8"	1 1/8"		7 1/2"	11 5/8"	3 1/4"			
2 "	SCRD	8 1/2"	2 1/8"		11 1/2"	10 1/2"	6 1/2"			
	FLGD	9"		3	11 1/2"	10 1/2"	6 1/2"	9 1/8"	14 1/2"	14"
	GRVD	8 3/4"	2 1/8"		11 1/2"	10 1/2"	6 1/2"			
250 S/FGT	SCRD			1 3/4"				10 1/2"		
	FLGD			3 1/4"				10 1/2"		
3 "	SCRD	12"	3 1/16"		13"	12"	8 1/2"			
	FLGD	12 3/16"		3 3/4"	13"	12"	8 1/2"	12 5/16"	16 1/2"	15 1/2"
4 "	SCRD	15"	4"		14 1/2"	13 3/16"	10 1/2"			
	FLGD	15 1/8"		4 1/2"	14 1/2"	13 3/16"	10 1/2"	15"	18 1/2"	16 11/16"
6 "	FLGD	22 1/8"		5 1/2"	17"	14 7/8"	16"	22"	20 1/2"	18 3/8"

FLANGE DIMENSIONS ARE ASA 150 LB. STANDARD. *Add 7/8" to PRB and USDP Regulators for this dimension.

RAM P/N AG00213
PRESSURE REDUCING
BALANCED REGULATOR

OPERATION:

The Pilot Assembly and Motor Valve Stem Assembly (Crosshatched) are the only moving units in the regulator.

The PILOT PLUG consists of two stainless balls rigidly connected together. Upstream Pressure (Red) is the supply pressure to the pilot and is also in constant communication with the top side of the MOTOR VALVE DIAPHRAGM. The area of the MOTOR VALVE DIAPHRAGM is twice the area of the motor valve seat, assuring a positive shut-off.

The lower seat for the PILOT PLUG is the Motor Valve Diaphragm Pressure inlet (Red to Yellow). The upper seat for the PILOT PLUG is the pressure vent (Yellow to Atmosphere). The PILOT SPRING loads the upper side of the Pilot Assembly and is opposed on the underneath side by the controlled Downstream Pressure (Blue).

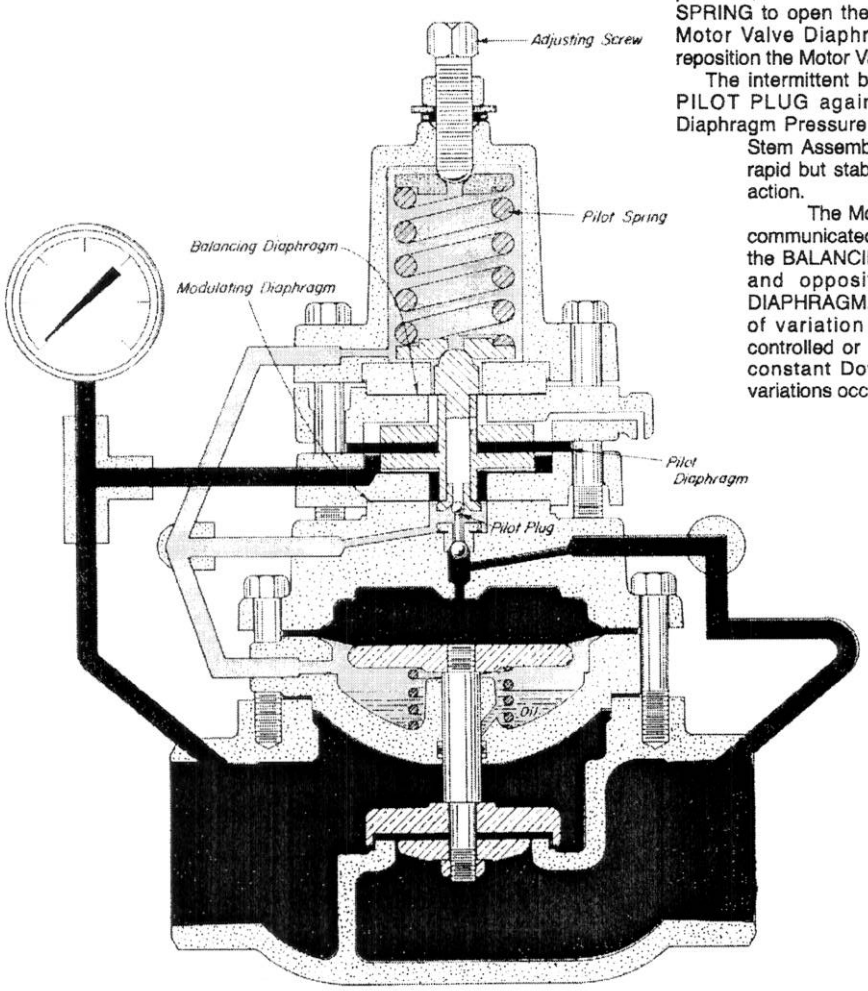
Assume the PILOT SPRING is compressed with the ADJUSTING SCREW for a desired Downstream Pressure setting. With Downstream Pressure (Blue) too low, the PILOT SPRING forces the Pilot Assembly downward to close the upper seat (Yellow to Atmosphere) and open the lower seat (Red to Yellow).

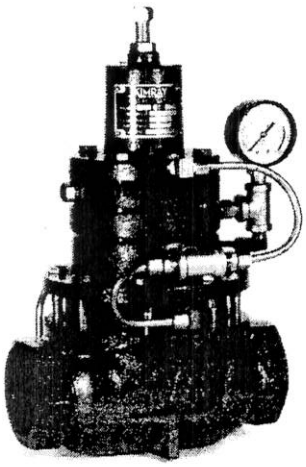
This lets full Upstream Pressure (Red) load the underneath side of the MOTOR VALVE DIAPHRAGM to balance the pressure on the top side. Upstream Pressure (Red) acting under the motor valve seat, opens the valve. As Downstream Pressure (Blue) increases to the set pressure, the Pilot Assembly assumes a position in which both seats of the PILOT PLUG are closed.

Should Downstream Pressure (Blue) rise above the set pressure, the Pilot Assembly moves upward against the PILOT SPRING to open the pressure vent (Yellow to Atmosphere). Motor Valve Diaphragm Pressure (Yellow) decreases to reposition the Motor Valve Stem Assembly.

The intermittent bleed pilot, three-way valve action of the PILOT PLUG against its seat adjusts the Motor Valve Diaphragm Pressure (Yellow), repositioning the Motor Valve Stem Assembly to accommodate any rate of flow. The rapid but stable repositioning produces a true throttling action.

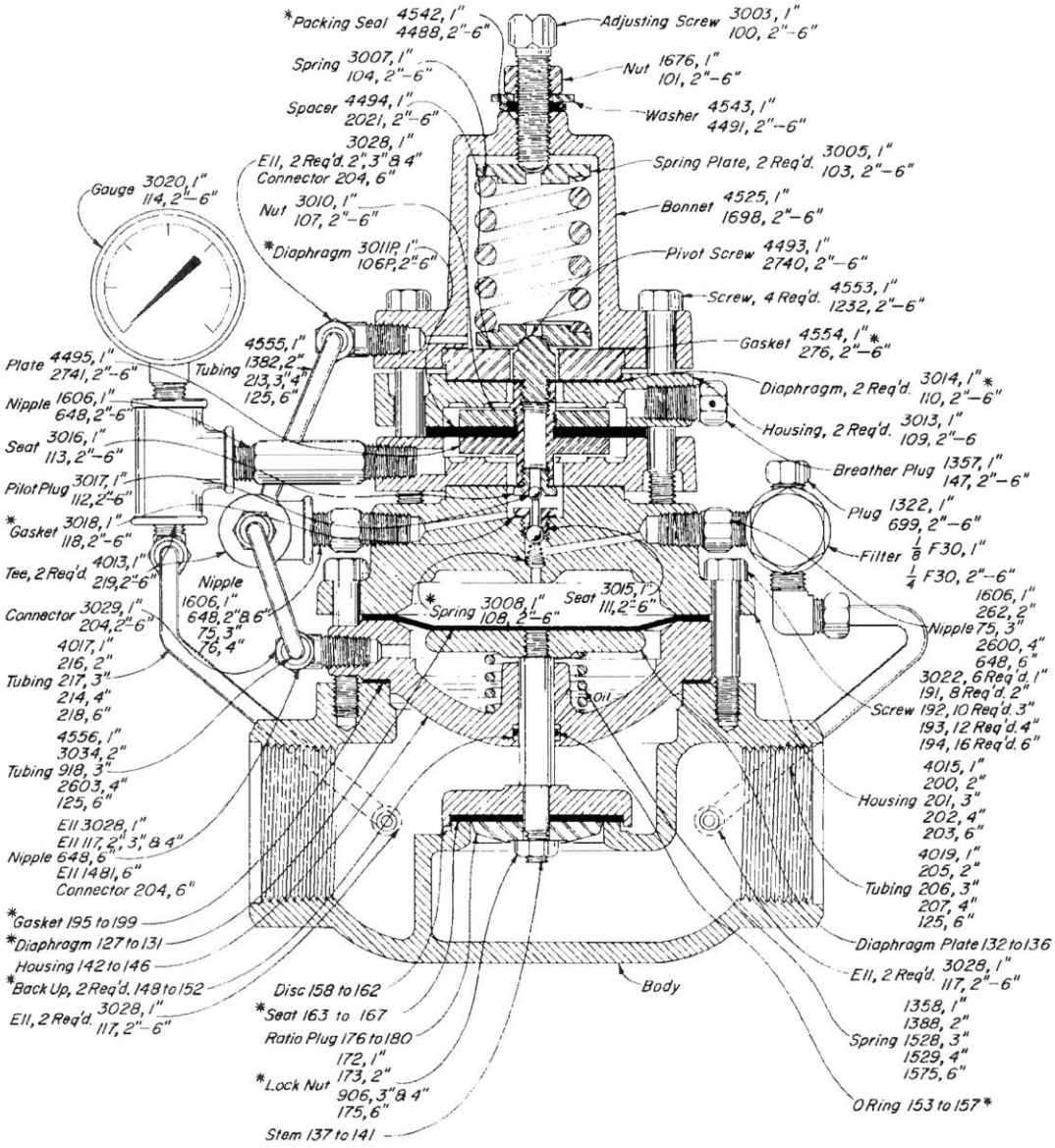
The Motor Valve Diaphragm Pressure (Yellow) is communicated to the bonnet area, this pressure acts on the BALANCING DIAPHRAGM to counteract the equal and opposite pressure on the MODULATING DIAPHRAGM. This balancing action reduces the effect of variation in Upstream Pressure (Red) on the controlled or Downstream Pressure (Blue) resulting in constant Downstream Pressure (Blue) when 10:1 variations occur in Upstream Pressure (Red).



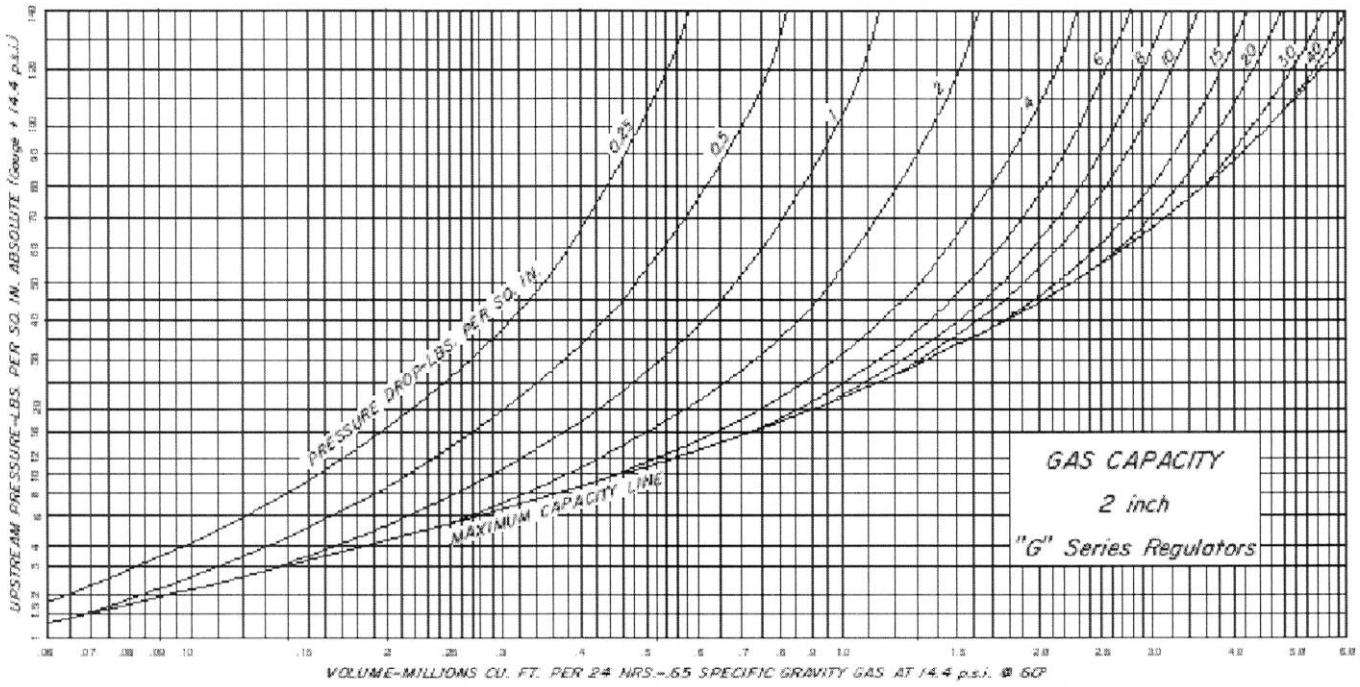


RAM P/N AG00213
PRESSURE REDUCING
BALANCED REGULATOR

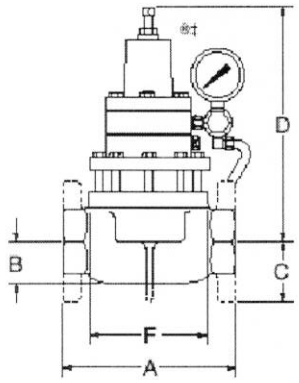
1", 2", 3", 4" & 6" S/F/GGT PRB
CAST IRON
125 lbs. W.P.



RAM P/N AG00213
PRESSURE REDUCING
BALANCED REGULATOR



CAST IRON OR DUCTILE



LINE SIZE	BODY STYLE	A	B	C	D*	E	F	G	H*	I
1 "	SCRD	4 3/8"	1 1/8"		7 1/2"	11 5/8"	3 1/4"			
2 "	SCRD	8 1/2"	2 1/8"		11 1/2"	10 1/2"	6 1/2"			
	FLGD	9"		3	11 1/2"	10 1/2"	6 1/2"	9 1/8"	14 1/2"	14"
	GRVD	8 3/4"	2 1/8"		11 1/2"	10 1/2"	6 1/2"			
250 S/FGT	SCRD			1 3/4"				10 1/2"		
	FLGD			3 1/4"				10 1/2"		
3 "	SCRD	12"	3 1/16"		13"	12"	8 1/2"			
	FLGD	12 5/16"		3 3/4"	13"	12"	8 1/2"	12 5/16"	16 1/2"	15 1/2"
4 "	SCRD	15"	4"		14 1/2"	13 3/16"	10 1/2"			
	FLGD	15 1/8"		4 1/2"	14 1/2"	13 3/16"	10 1/2"	15"	18 1/2"	16 11/16"
6 "	FLGD	22 1/8"		5 1/2"	17"	14 7/8"	16"	22"	20 1/2"	18 3/8"

FLANGE DIMENSIONS ARE ASA 150 LB. STANDARD. *Add 7/8" to PRB and USDP Regulators for this dimension.

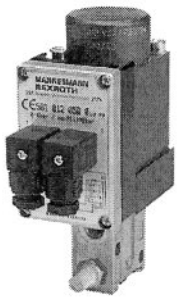
E/P Pressure control valves

ND 4, analogue, proportional solenoid

RAM P/N AG35257

Technical Data

Type		Poppet valve
Supply pressure		Max. 8 bar (116 psi)
Output pressure		0 bar ... 6 bar * (0 – 87 psi)
Hysteresis		< 0,06 bar (<1 psi)
Nominal flow rate Qn at supply pressure = 7 bar (102 psi) output pressure = 6 bar (87 psi) and Δp = 0,2 bar (3 psi)		350 l/min. (0.35 Cv)
Ambient temperature range		0 °C to +50 °C (+32 °F to +122 °F)
Medium		Condensate-free and non-lubricated compressed air, filtered 50 µm
Weight		1,3 kg (2.866 lbs)
Materials	Body	Zn-diecasting, Al, POM, chromated steel
	Seals	NBR (Nitrile Butadiene Rubber)
Supply voltage		24 V DC± 10 %
Permissible ripple		5%
Current consumption	max.	1,2 A
Protection with plug		IP 55 to IEC 529 (DIN VDE 0470)
Installation position		Vertical

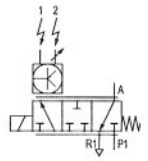


* Technical details for changing factory adjusted characteristic on request.

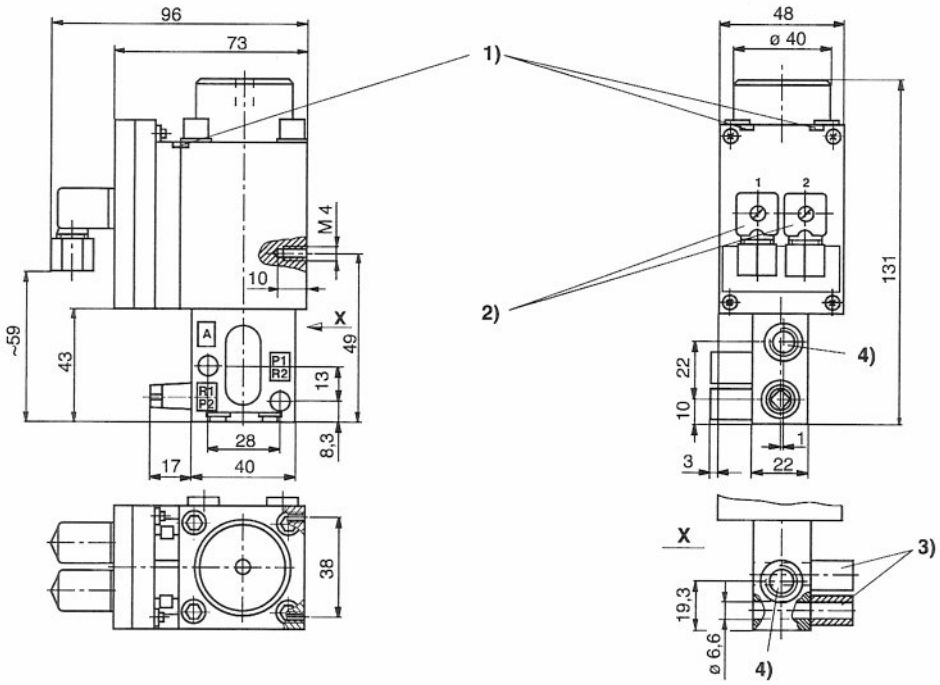
Application area

Electro-pneumatic pressure control valves convert an electrical signal (current, voltage, resistance) proportionally into pneumatic pressure. They are used where electrical control is required to act directly on a change of pressure or force.

Part no.

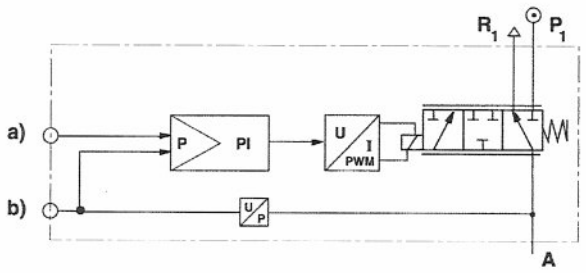
	Supply pressure max.* [bar] (psi)	Output pressure [bar] (psi)	Nominal input value		
	8 (116)	0 ... 6 (0..87)	0–10 V or potentiometer		

*min. supply pressure: 0,5 bar (7 psi)+ max. required output pressure



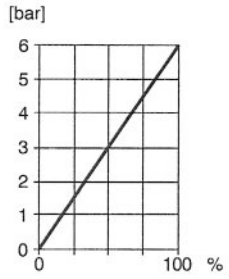
1) Mounting space for nameplate 2) El. connector can be fixed at 90° intervals 3) 2 spacer bushes are supplied loose
4) Universal threaded connection, suitable for G1/8 to ISO228/1 and 1/8-27 NPTP

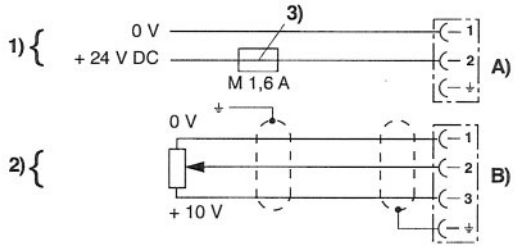
Functional diagram



a) Nominal input value. b) Actual output value.
The Electro-pneumatic pressure control valve modulates the pressure corresponding to an analogue electrical nominal input value. The integrated electronics make a comparison between the nominal input value and the pressure in the output line (actual value), which is measured by a piezo-resistive pressure sensor. The controller generates a setting, which is controlled by a voltage/current converter and a proportional solenoid, in order to obtain the required pressure.

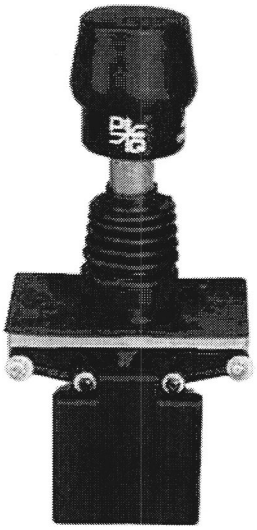
Characteristic and pin assignment for potentiometer control without actual output value (561 012 060 0)

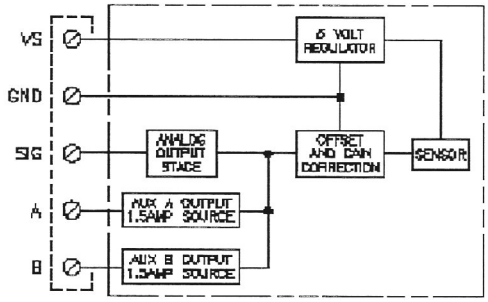




1) Supply voltage. 2) Potentiometer control (0 - 2 kΩ min., 0 - 10 kΩ max.). 3) The supply voltage must be protected by an external M 1,6 A. fuse. Shielding must comply with local limiting conditions. In extreme cases the power supply must also be shielded.
A) Plug 1. B) Plug 2.

RAM P/N AG35306
JOYSTICK CONTROLLER



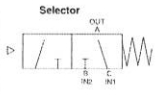


NOTES: 1) VOLTAGE SUPPLY IS TO BE 10–30VDC.
2) CURRENT CONSUMPTION: 20mA @ 12VDC.
OUTPUT: CENTERED – 0.00V ±0.5V.
FULL POSITIVE DEFLECTION – 10.00V ± 1.00V.
FULL NEGATIVE DEFLECTION – 10.00V ± 1.00V.
3) AUX A OUTPUT SWITCHES ON ⊕ APPROX. 2.00V WITH THE POSITIVE ANALOG OUTPUTS (X+, Y+). AUX B OUTPUT SWITCHES ON ⊖ APPROX. 2.00V WITH THE NEGATIVE ANALOG OUTPUTS (X–, Y–).

RAM P/N AG35317
POPPET VALVE

Below listed operators are single air operators with spring returns.

3-Port/2-Position (3 way) Multi-Directional Inline

Symbol	Basic Size	Port Size	Model	Operating Pressure psig (bar)	Pilot Pressure psig (bar)	Weight lbs.(kg)	Repair Kit§
	1/2"	1/4"	AG35317	0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	1.41 (0.64)	53474-03
		3/8"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	1.41 (0.64)	53474-03
		1/2"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	1.41 (0.64)	53474-03
		3/4"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	1.41 (0.64)	53474-03
	1"	3/4"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	3.94 (1.79)	53475-01
		1"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	3.94 (1.79)	53475-01
		1-1/4"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	3.94 (1.79)	53475-01
	2"	1-1/2"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	8.75 (3.97)	53822-01
		2"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	8.75 (3.97)	53822-01

§ **Repair Kit:** Kit contains all elastomers necessary to service one valve body.

Note: Pilot supply pressure must be equal to or greater than the operating pressure.

RAM P/N AG35316
POPPET VALVE

Technical Data

Medium:
Filtered and lubricated or non-lubricated compressed air or vacuum.

Operation:
Poppet valve air pilot actuated.

Mounting:
Through-holes in valve body and subbase.

Port Size:
1/4" to 2" PTF, BSPP, or ISO Rc.

Operating Pressure:
300 psig (Maximum 20.7 bar). For details see overleaf.

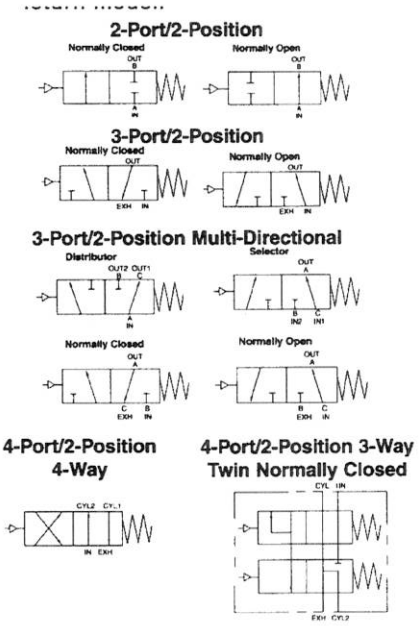
Flow Characteristics:

Basic Size	Function	Cv*	l/min
1/4"	3/2 & 4/2	1.2 - 1.8	984 - 2,435
1/2"	2/2, 3/2 & 4/2	3.2 - 5.8	3,398 - 6,230
1"	2/2, 3/2 & 4/2	10.3 - 17.7	4,474 - 15,348
2"	2/2 & 3/2	39.6 - 49.5	38,228 - 54,085

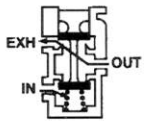
*See VAL-12-58 for additional flow information.

Operating Temperature:
-20°F to 175°F** (-29°C to 79°C)
**Consult Technical Service for use below 35°F (+2°C).

Materials:
Body: Aluminum alloy body, piston, poppets and subbase.
Operators: Zinc or aluminum air pilot operators.
Elastomers: Nitrile rubber seals. (Fluorocarbon seals are optional, contact Technical Services.)



This example shows a 3-way normally closed valve.



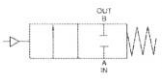
RAM P/N AG35316

POPPET VALVE

Air Pilot Operated Spring Return Inline and Subbase Valves

Below listed operators are single air operators with spring returns.

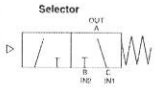
2-Port/2-Position (2 way) Inline, Normally Closed

Symbol	Basic Size	Port Size	Model	Operating Pressure psig (bar)	Pilot Pressure psig (bar)	Weight lbs.(kg)	Repair Kit§
	1/2"	1/4"	AG35316	0 - 300 (0 - 20.7)	30 -300 (2.1 - 20.7)	1.51 (0.69)	53474-03
		3/8"		0 - 300 (0 - 20.7)	30 -300 (2.1 - 20.7)	1.51 (0.69)	53474-03
		1/2"		0 - 300 (0 - 20.7)	30 -300 (2.1 - 20.7)	1.51 (0.69)	53474-03
		3/4"		0 - 300 (0 - 20.7)	30 -300 (2.1 - 20.7)	1.51 (0.69)	53474-03
	1"	3/4"		0 - 300 (0 - 20.7)	30 -300 (2.1 - 20.7)	3.69 (1.68)	53475-01
		1"		0 - 300 (0 - 20.7)	30 -300 (2.1 - 20.7)	3.69 (1.68)	53475-01
		1-1/4"		0 - 300 (0 - 20.7)	30 -300 (2.1 - 20.7)	3.69 (1.68)	53475-01
	2"	1-1/2"		0 - 300 (0 - 20.7)	30 -300 (2.1 - 20.7)	8.05 (3.65)	53822-01
		2"		0 - 300 (0 - 20.7)	30 -300 (2.1 - 20.7)	8.05 (3.65)	53822-01

RAM P/N AG00182
POPPET VALVE

Below listed operators are single air operators with spring returns.

3-Port/2-Position (3 way) Multi-Directional Inline

Symbol	Basic Size	Port Size	Model	Operating Pressure psig (bar)	Pilot Pressure psig (bar)	Weight lbs.(kg)	Repair Kit§
	1/2"	1/4"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	1.41 (0.64)	53474-03
		3/8"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	1.41 (0.64)	53474-03
		1/2"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	1.41 (0.64)	53474-03
		3/4"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	1.41 (0.64)	53474-03
	1"	3/4"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	3.94 (1.79)	53475-01
		1"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	3.94 (1.79)	53475-01
		1-1/4"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	3.94 (1.79)	53475-01
	2"	1-1/2"		0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	8.75 (3.97)	53822-01
		2"	**AG00182**	0 - 300 (0 - 20.7)	30 - 300 (2.1 - 20.7)	8.75 (3.97)	53822-01

§ **Repair Kit:** Kit contains all elastomers necessary to service one valve body.
Note: Pilot supply pressure must be equal to or greater than the operating pressure.

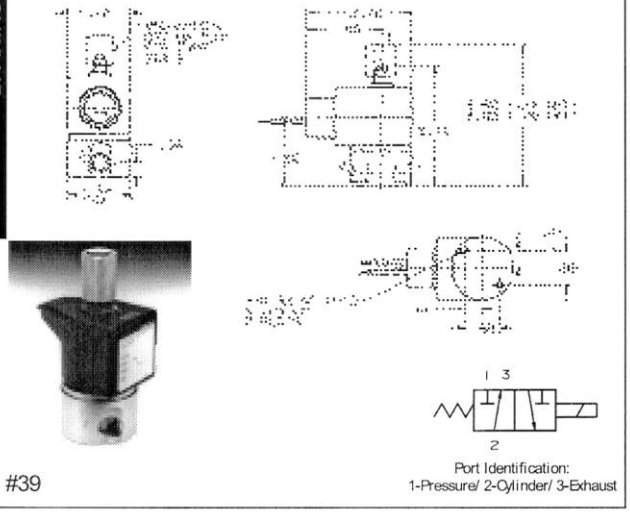
RAM P/N AG35318
3-Way Solenoid Valve

DIRECT ACTING STAINLESS STEEL VALVES–NORMALLY CLOSED, NBR OR FKM SEALS

Pipe Size NPT	Orifice Body NC (inch)	Orifice Body NO (inch)	Orifice Sleeve Size (inch)	Cv Factor NC	Cv Factor NO	Operating Pressure Differential (PSI)					Max.* Fluid Temp. (F)	Pressure Vessel Catalog Number	UL/CSA** Approval	Const. Ref.
							Maximum							
							AC Ratings		DC Ratings					
						Min.	10 watt	22 watt	10 watt	22 watt				
1/4"	3/64		1/16	0.062	0.095	0	250		250		185	71315SN2ENJ	GP	39

* Maximum fluid temperatures are provided for Class F coils. Valves with FKM seals (letter 'V' in the 10th position of pressure vessel number) can be used at fluid temperatures up to 240° F on DC and 250° F on AC provided a Class H coil is used.

DRAWINGS

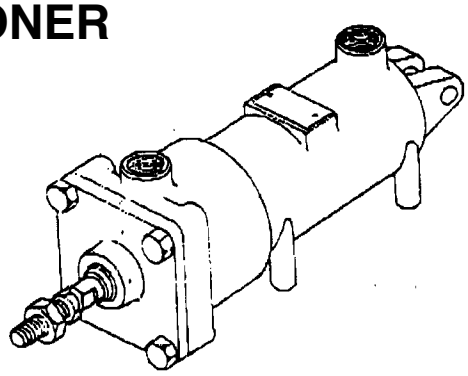


#39

Port Identification:
1-Pressure/ 2-Cylinder/ 3-Exhaust

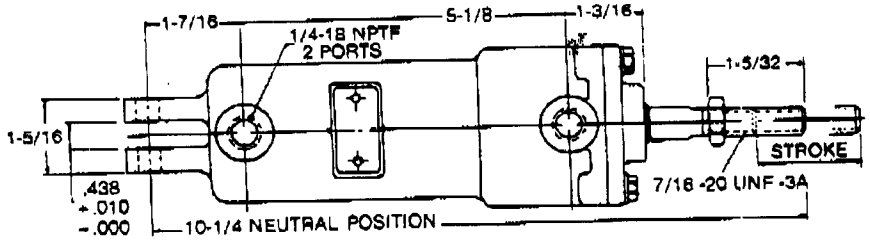
Direction POSITIONER

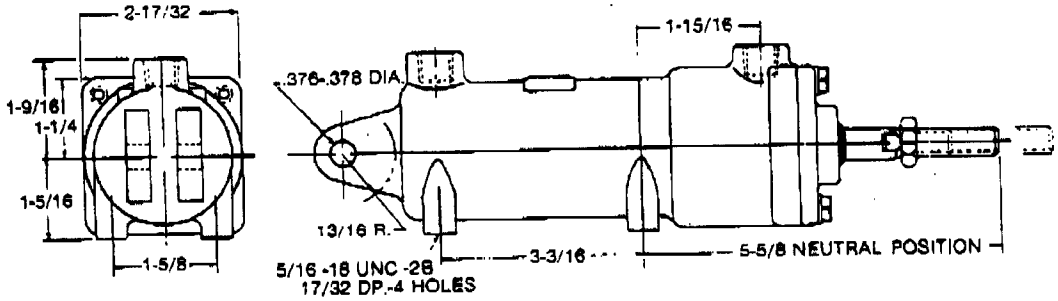
AM P/N AG04725



An extremely versatile type, the Two-Direction positioners move 1/2 their total stroke length in each direction from a center "zero" position. They are compact, economical, accurate linear piston type with three total stroke lengths, 1", 1-1/2" and 2".

ORDERING INFORMATION				
PIECE NO.	PRESSURE RANGE (PSI)	FORCE RATING (Inch-lb.-degrees	TOTAL STROKE LENGTH	WEIGHT
P58822-0500	5-80	410	1"	2.5 lbs.
P58822-0750	5-115	615	1½"	2.6 lbs.
P59833-1000	10-60	820	2"	2.7 lbs.
P64076-1000	10-90	820	2"	2.7 lbs.





The two-direction positioner is a low-sensitivity, infinite positioning device that is controlled by a graduating control valve, such as our Type "H" Controlair® Valve. Type M PLUS™ Pressure Control Valve or Flexair® Valve as shown in the Special Duty Valves section in catalog SC-700. The positioner has a wide range of applications including positioning of 4-way hydraulic valves, over center hydraulic pumps and other low-force mechanisms. It is corrosion-resistant and constructed of lightweight, die-cast, anodized aluminum with a chrome-plated piston rod and long-wearing synthetic rubber seals.

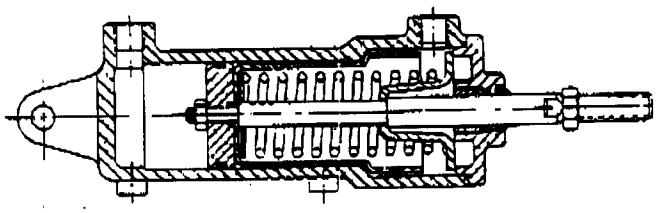
Maximum stroke of the piston rod is one inch on each side of the center position, making a total piston rod travel of two inches. External envelope dimensions of the positioner do not change.

NOTE: Control pressure should match the operating pressure of the positioner to eliminate any lost motion in the control valve.

RAM P/N AG04725

OPERATION

Maximum pressure of the two-direction positioner is 150 psi at a temperature range of -40 F to 165 F. The positioner is held in its center position by a coil spring caged on the piston rod. When air pressure is supplied to the Cap-End Port, the piston rod moves to its extended position. When pressure is supplied to the Head-End Port, the piston rod moves to its retracted position.



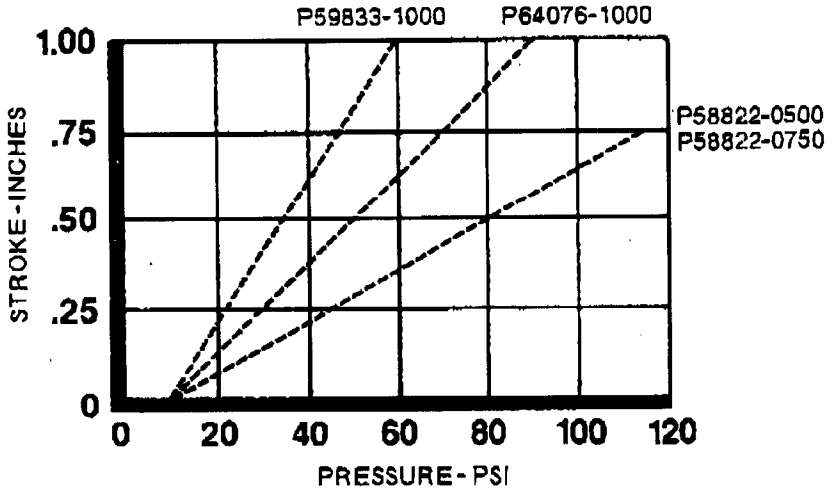
ASSEMBLY VIEW

AVAILABLE FORCES

The accompanying graph shows pressure in psi required to overcome the force of the spring as the piston rod is retracted or extended from its center position. From the graph, pounds of spring force can be determined by multiplying the pressure (psi) by the piston area. The following force ratings are based on 3 psi x 2.4 square inches (piston area).

P58822-0500	410 in.-lb.-degrees or 7lbs. through 1" total travel.
P58822-0750	615 in.-lb.-degrees or 7lbs. through 1½" total travel.
P59833-1000 & P64076-1000	820 in.-lb.-degrees or 7lbs. through 2" total travel.

To determine the control valve output pressure at any piston travel for either retracted or extended strokes, project across the graph from the appropriate stroke length point on the vertical line until the pressure line is intersected. Project down from this point to arrive at the pressure in psi. This is the no-load pressure required of the valve. Normally 3 psi above this is required to move a load of 7 lbs.



PISTON AREA: EXTENDED 2.4 sq. in.
RETRACTED 2.2 sq. in.

Mounting kits to mount this 2D Positioner on Sunstrand hydraulic pumps are available. Request brochure A9-150.07. Consult factory for recommendations for other hydraulic pump brands.

RAM P/N AG04713
MANUAL CONTROL VALVE

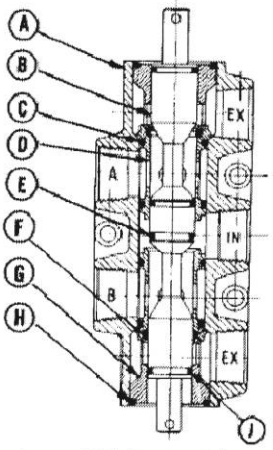
and

RAM P/N AG04714
REMOTE CONTROL
PILOT OPERATED VALVE

RAM P/N AG04713

MANUAL CONTROL VALVE — 4 Way – 3 Position Manual Control

Valve Body Assembly 1 ¼" Ports

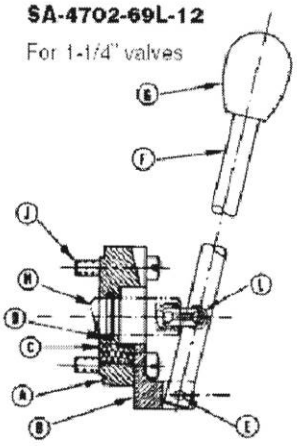


Approx. Weight = 11.40 lbs. (5.17 kg)

LEGEND	PART NAME	PART NUMBER			UNITS REQ.
		3/4"	1"	1 1/4"	
A	Body (Side Ports — EXPilot)	4602-01	4702-01	4702-01-12	One
	Body (Side Ports — INPilot)	4622-01	4722-01	4722-01-12	One
	Body (Sub-plate Mtg. — EXPilot)*	4712-01*		4712-01-12*	One
	Body (Sub-plate Mtg. — INPilot)*	4732-01*		4732-01-12*	One
B	Plunger	4702-05††		4702-05-12††	One
C	"O" Ring	P-1000-25		P-1000-27	Four
D	Bushing	4702-04		4702-04-12	Two
E	"O" Ring	P-1100-17†		P-1100-20	Two
F	"O" Ring	P-1100-21†		P-1100-24	Two
G	Retainer	4702-43		4702-43-12	Two
H	"O" Ring	P-1004-02		P-1004-02	Two
J	"O" Ring	P-1000-17		P-1000-24	Two

Hand Lever Assembly

SA-4702-69L-12
For 1-1/4" valves

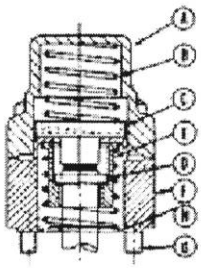


Approx. Weight = 1.50 lbs. (0.68 kg)

LEGEND	PART NAME	PART NUMBER			UNITS REQ'D
		1/8" thru 1/2"	3/4" and 1"	1 1/4"	
A	Lever Cap	4302-18L	4702-18L	4702-18L-12	One
B	Knuckle	4302-23D	NONE	NONE	One
	Bracket	NONE	4702-23L	4702-23L	One
C	Gland Boot	4302-19D	NONE	NONE	One
	Filter	NONE	4702-19L	4702-19L	One
D	"O" Ring	P-1100-13	P-1000-12	P-1000-09	One
E	Screw	4302-20D	NONE	NONE	One
	Pin	NONE	4302-27	4302-27	One
F	Handle	4302-24D	4702-24L	4702-24L	One
G	Knob	P-1001-10D	P-1001-10D	P-1001-10D	One
J	Screw	PFS-1032-24	PAS-2528-16	PAS-2528-32	Four
K	Washer	4302-02	NONE	NONE	One
L	Link Assembly	4302-83	4302-83	4302-83	One
M	Clip	4302-22D	NONE	NONE	One
	Screw (Not Shown)	NONE	PSS-1032-04	PSS-1032-04	One
N	Rod	NONE	NONE	4702-19L-12	One

Spring-Center Cap Assembly

SA-4702-72-12
For 1 ¼" Valves

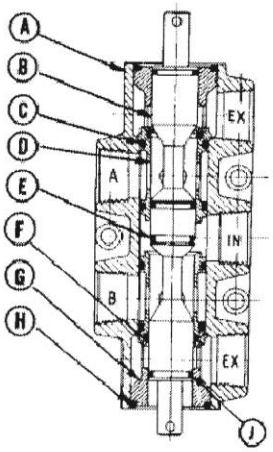


LEGEND	PART NAME	PART NUMBER			UNITS REQ'D
		1/8" thru 1/2"	3/4" and 1"	1 1/4"	
A	Spring Cap	4302-12	4702-12	4702-34-12	One
B	Spring	4302-06	4702-06	4702-06	Two
C	Cup Washer	4302-31	4702-31	4702-36-12	One
D	Pin	4302-22	4702-22	NONE	One
E	Spring Cup	4302-14	4702-14	NONE	One
F	Spacer	4302-10D	4702-10D	NONE	One
G	Screw	PFS-1032-32	PAS-2528-36	PAS-2528-40	Four
H	Washer	4302-02	4702-02	NONE	One
J	Rod (Not Shown)	NONE	NONE	4702-35-12	One

RAM P/N AG04714

PILOT OPERATED VALVE — 4 Way – 3 Position Pilot Control

Valve Body Assembly 1 ¼" Ports

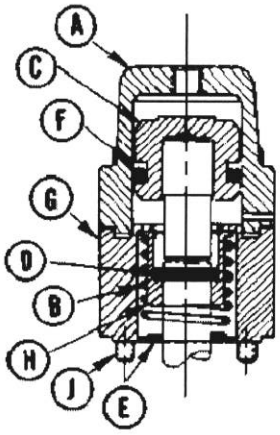


Approx. Weight = 11.40 lbs. (5.17 kg)

LEGEND	PART NAME	PART NUMBER			UNITS REQ.
		¾"	1"	1¼"	
A	Body (Side Ports — EXPilot)	4602-01	4702-01	4702-01-12	One
	Body (Side Ports — INPilot)	4622-01	4722-01	4722-01-12	One
	Body (Sub-plate Mtg. — EXPilot)*	4712-01*		4712-01-12*	One
	Body (Sub-plate Mtg. — INPilot)*	4732-01*		4732-01-12*	One
B	Plunger	4702-05††		4702-05-12††	One
C	"O" Ring	P-1000-25		P-1000-27	Four
D	Bushing	4702-04		4702-04-12	Two
E	"O" Ring	P-1100-17†		P-1100-20	Two
F	"O" Ring	P-1100-21†		P-1100-24	Two
G	Retainer	4702-43		4702-43-12	Two
H	"O" Ring	P-1004-02		P-1004-02	Two
J	"O" Ring	P-1000-17		P-1000-24	Two

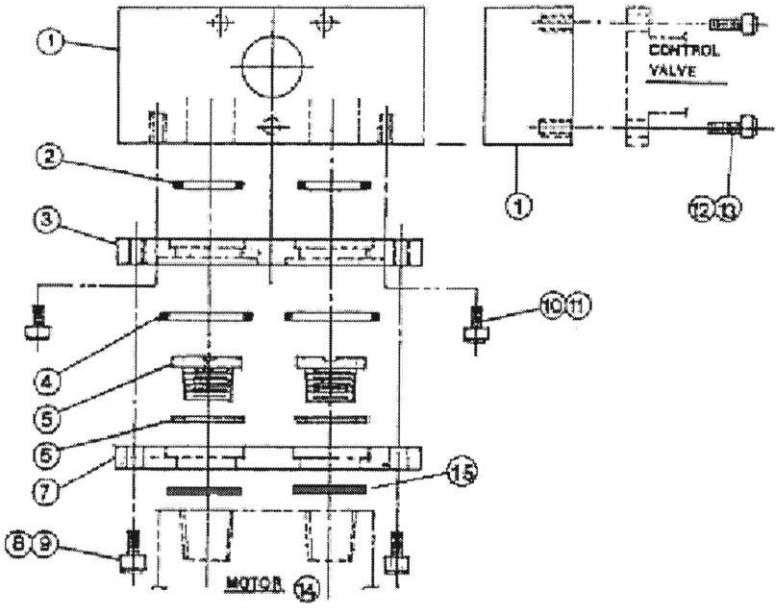
SA-4702-83-12

Pilot Spring Center Cap Assembly



LEGEND	PART NAME	PART NUMBER			UNITS REQ'D
		⅛" thru ½"	¾" and 1"	1¼"	
A	Pilot Cap	4302-11	4702-11	4702-11	One
B	Spring	4302-06	4702-06	4702-06	One
C	Piston	4302-38	4702-38	4702-38-12	One
D	Pin	4302-22	4702-22	NONE	One
E	Washer	4302-02	4702-02	NONE	"
F	"O" Ring	P-1000-17	P-1000-23	P-1000-23	One
G	Pilot Spacer	4302-32D	4702-32D	4702-32D	One
H	Spring Cup	4302-14	4702-14	4702-31-12	One
J	Screw	PFS-1032-36	PAS-2528-40	PAS-2528-40	Four

CONTROL VALVE
PLATE ASSEMBLY



ITEM No.	PART No.	DESCRIPTION	QTY.
1	400866	Valve Sub-Plate	1
2	400950	O-Ring	2
3	400660	Sandwich Plate	1
4	400951	O-Ring	1
5	400710	Thread Inlet Bushing	2
6	400950	O-Ring	2
7	400711	Adapter	1
8	400542	Hex Hd. Cap Screw 3/8 x 1 1/2"	4
9	400790	3/8 Lock Washer	4
10	400644	Allen Hd. 3/8 x 7/8" Cap Screw	5
11	400790	3/8 Lock Washer	5
12	400954	Allen Hd. 3/8 x 3/4" Cap Screw	3
13	400790	3/8 Lock Washer	3
14	400719	Air Motor	1
15	401134	Neopr. Spacer Ring	2