



**P7170**  
**03540739**  
Edition 4  
March 2014

# **Turbine Powered Starters**

**Series TS700**

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# **Installation and Maintenance Information**



**Save These Instructions**

**IR** *Ingersoll Rand*

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## Product Safety Information

### Intended Use:

These air starters are intended for use in starting reciprocating internal combustion engines. These starters are designed to be operated from a remote location after proper installation on the engine requiring starting.

For additional information refer to Air Starters for Internal Combustion Engines Product Safety Information Manual Form 45558624. Manuals can be downloaded from [ingersollrandproducts.com](http://ingersollrandproducts.com)

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## Model TS700 Turbine-Powered Starter Operating Guidelines

### WARNING

- Never exceed the Nameplate pressure rating.
- Always release the start button immediately after the engine starts.

### NOTICE

- Whenever assembling the exhaust cover to the starter, be sure to add 15 ml of grade C3 turbine oil to the pipe plug hole marked "oil here".
  - If the engine has not started after 30 seconds of cranking, refer to the engine maintenance guides for information on starting, ignition, and fuel systems.
  - When using the starter for dynamic timing measurements, rest the starter for 2-3 minutes between 30 second measurements.
  - ST900-267-24 Strainer or equivalent is required for all starters used in GAS applications.
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## Placing the Starter in Service

### Installation

#### NOTICE

For maximum performance, read this manual prior to the installation or operation of Series TS700 Turbine-Powered Starters.

### General Information

1. All pipe connections to the starter must be designed to provide continuously leak proof joints. Piping the starter should not impose stress on the starter as the result of operating vibration, thermal expansion or unsupported weight.
2. All piping, hoses, fittings and components must be clean, free of weld splatter, and any contamination that can enter the starter.
3. The exhaust of the starter has a 90° housing for use in piping away the exhaust (ST700K-350). Refer to Dwg. TPA1471 for instructions.
4. The installation of the starter must comply with all appropriate specifications; such as torquing threaded fasteners and fittings, lubrication as installed and during operation, air (or gas) flow to and from the unit, cleanliness and safety.
5. It is required that a Strainer be installed in the inlet line for each starter. Ingersoll-Rand offers 3 sizes of Strainers: ST900-267-24 for 1-3/4 inch lines, ST900-267-32 for 2 inch lines and ST900-267-64 for 4 inch lines. These 150 mesh strainers provide 100 micron filtration and offer significant protection against supply line contaminants which could damage the turbine components. Replacement elements are ST900-266-24 for 1-3/4 inch, ST900-266-32 for 2 inch, and ST900-266-64 for 4 inch lines.
6. All air (gas) line connections must be bubble tight. Ingersoll-Rand No. 5MB-441 sealant applied to clean threads will help assure a leak proof system.
7. In gas installations, all exhausts must be piped to a safer location. This applies to the exhaust from the Relief Valve and the Control Valve (5MB-G618 or 150BMD-Z451B) as well as the starter exhaust.
8. If the supply air (gas) to the starter is at a higher pressure than that stamped on the nameplate of the starter, a pressure regulator must be installed in the supply line ahead of the relay valve. The pressure setting of the regulator is to be the operating pressure of the starter and not greater than the nameplate stamping. A relieving type regulator is recommended. If this type is not available it is important to install a relief valve between the regulator and relay valve. The opening pressure of the relief valve should be 15 psi. above the regulator setting.

9. The air supply lines between the relay valve, top control valve, and starter should be as short and free of fittings as practical.
10. The air supply lines should be arranged to provide drainage for condensation. This is especially important when the lines are long.
11. The starter, control components and air lines should be arranged so that they are protected from heat, vibration and contamination.
12. Apply a film of Dextron® \*II Automatic Transmission fluid to the driving spline and mount the starter using the Mounting Cap Screws. Tighten the Mounting Cap Screws to 40-45 ft-lbs (54-61 Nm) torque.
13. Refer to Dwg. TPA1464 for torque and lubrication specifications.

### Barring Over the Engine

The rotor shaft has a 1/4" hex socket in the end that can be used to rotate the engine shaft. This hex socket can be accessed by removing the directional exhaust 1/4" NPT plug (31) from that housing to access the 1/4" hex socket.

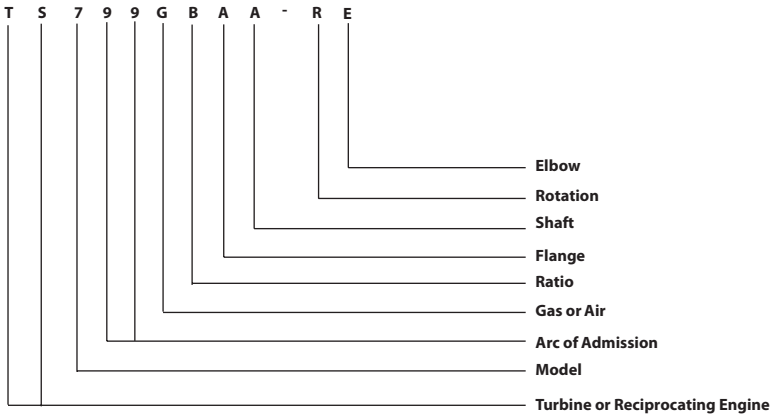
### Orientation of the Starter

Orientation refers to the rotational location of the lubrication ports in the Drive Housing, the rotational location of the air (gas) inlet, and if used, the rotational location of the directional exhaust cover. It is recommended that the correct orientation be ordered from the factory. If it is necessary to reorient the unit in the field, refer to Dwg. TPA1462 and proceed as follows:

1. To rotate the Drive Housing relative to the inlet:
  - a. Remove the Cap Screws (35) holding the Drive Housing (32) to the Gear Case.
  - b. Rotate the Drive Housing to the required position. Do not remove the Drive Housing from the Gear Case (3).
  - c. Install the Cap Screws (35) and tighten to 28 ft.-lbs. (38 Nm) torque.
2. To rotate the Directional Exhaust cover with respect to the inlet:
  - a. Remove the Starter Assembly Cap Screws (6).
  - b. Rotate the Exhaust Cover to it's required position. Do not remove the Cover from the Motor Housing or separate the Motor Housing and Gear Case.
  - c. Reinstall the Cap Screws (6) and tighten them to 60 ft.-lbs. (81.4 Nm) torque in 20 ft.-lbs. (27 Nm) increments.

\* Registered trademark of Exxon Corp.

## How to order a Starter

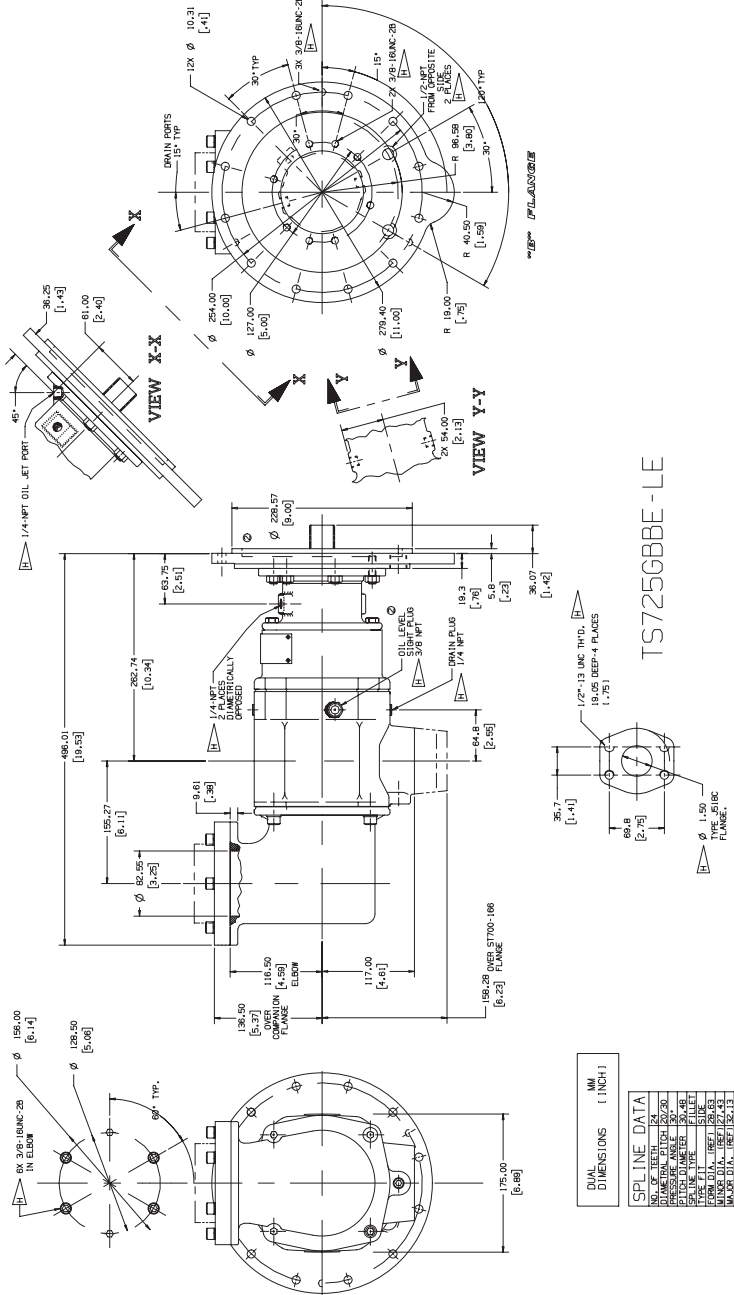


Model	Supply Pressure psi/ K <sub>pa</sub> Max	Pinion Data			
		No. of Teeth	Diametral Pitch	Pitch Diameter	PA
TS725GZAA-RE	225/1551	24	20/40	1.2	30
TS725GZAB-RE	225/1551	24	20/40	1.2	30
TS799GBAB-L	90/620	24	20/40	1.2	30
TS799TS799GBAD-L	90/620	16	20/30	0.8	30
TS799GBAA-L	90/620	24	20/40	1.2	30
TS725GBEE-LE	225/1551	24	20/30	1.2	30
TS725GBDE-LE	225/1551	24	20/30	1.2	30
TS725GZAA-RE	175/1206	24	20/40	1.2	30
TS725/VSPM-0005	225/1551	13	8/16	1.625	30
TS760GCAE-L	150/1034	24	20/30	1.2	30

\* Pinion Code must be specified when ordering.

For different models or special applications, contact your nearest Ingersoll-Rand distributor or Ingersoll-Rand Engine Starting Systems, Box 8000, Southern Pines, NC 28387 (910) 692-8700.

Mounting Dimensions (Pre-Engaged) for Series TS700 Starters



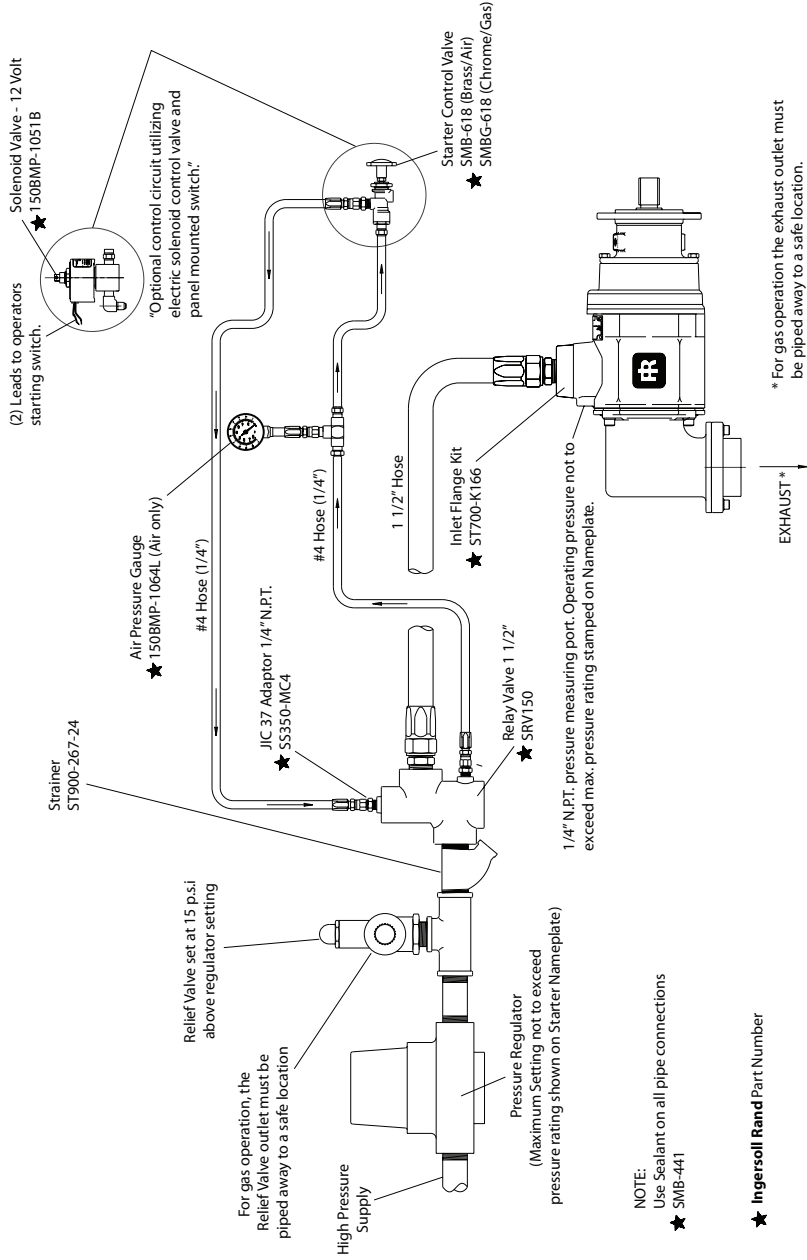
TS725GBBE-LE

DIMENSIONS (INCH)	
SPLINE DATA	
NO. OF TEETH	24
NO. OF GROOVES	20
PRESSURE ANGLE	30°
ADDENDUM	0.15
ADDENDUM COEFFICIENT	0.25
ADDENDUM MODIFICATION	0.00
ADDENDUM MODIFICATION COEFFICIENT	0.00
ADDENDUM MODIFICATION COEFFICIENT	0.00
ADDENDUM MODIFICATION COEFFICIENT	0.00
ADDENDUM MODIFICATION COEFFICIENT	0.00
ADDENDUM MODIFICATION COEFFICIENT	0.00



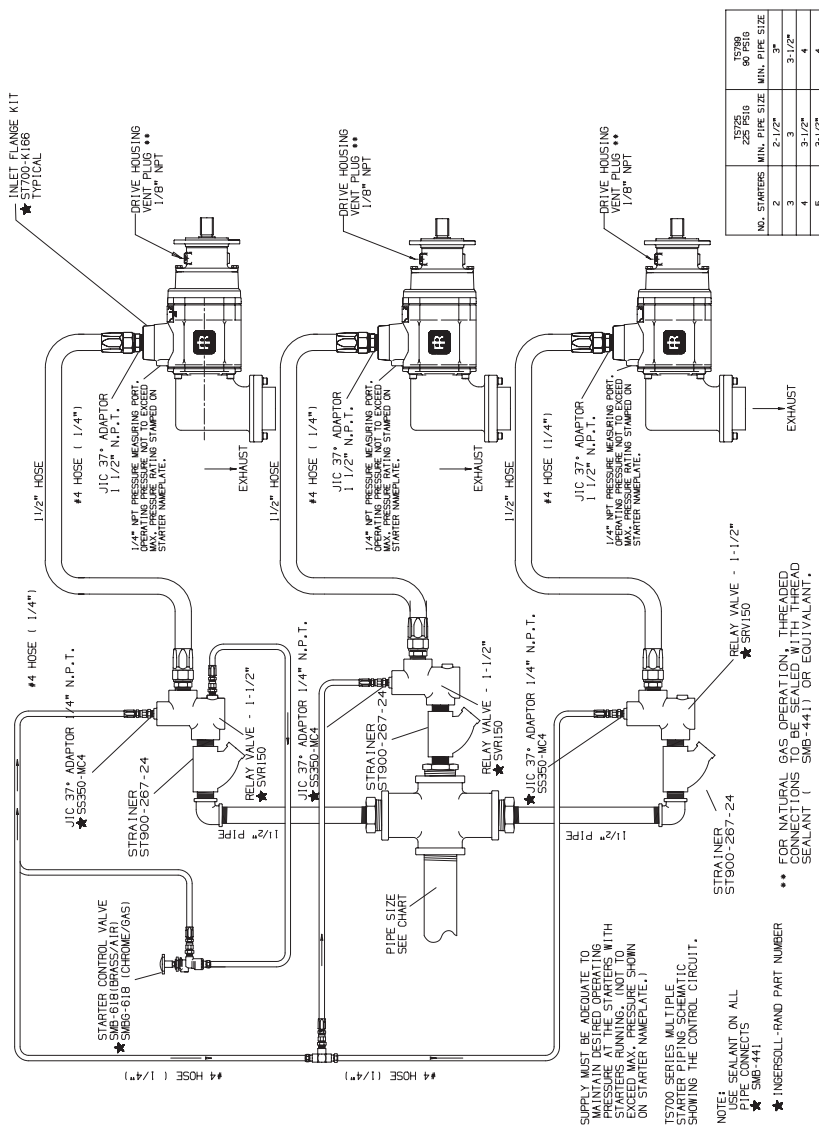
# Piping Diagram for a Typical TS700 Turbine Installation

## Piping Diagram for a typical TS700 Turbine Installation



(Dwg. TPA1466)

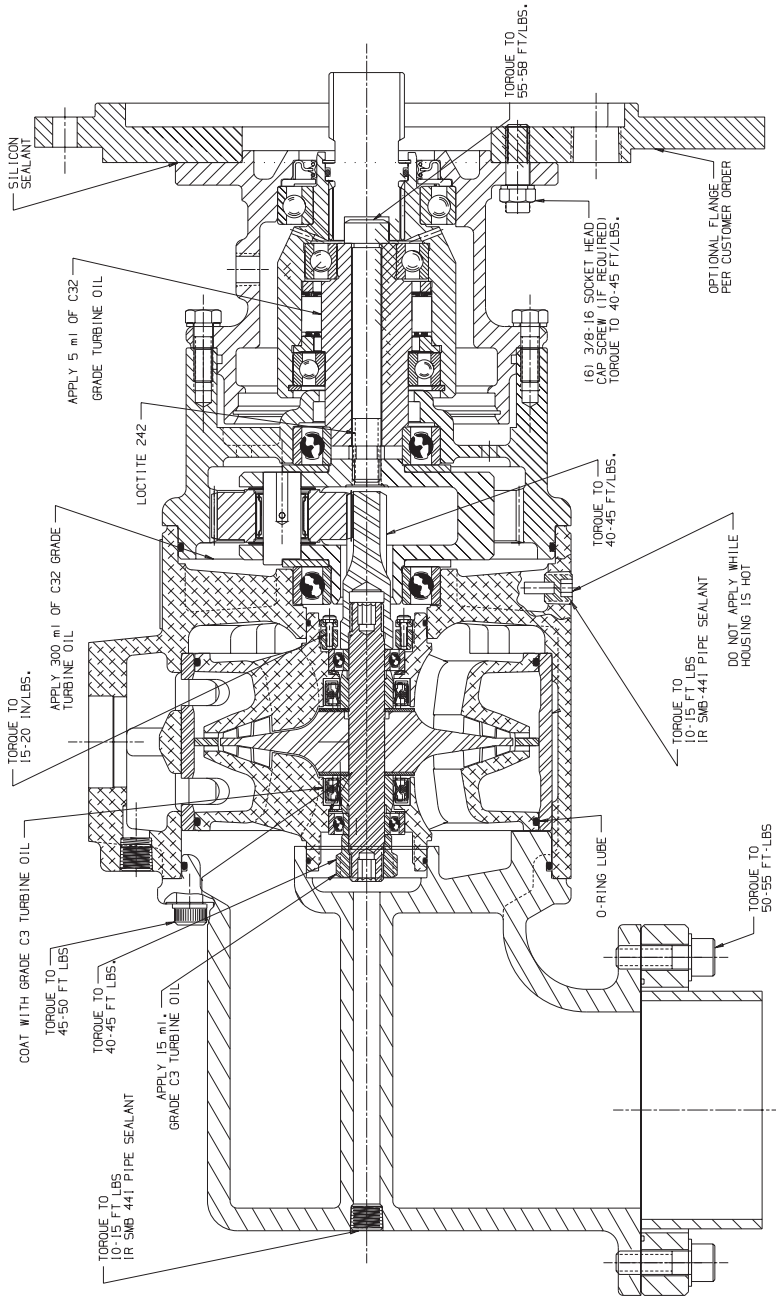
## Piping Diagram for a Typical TS700 Multiple Starter Installation



Series TS700 Turbine-Powered Starters are designed for air or gas operation in off-highway, marine and stationary applications.

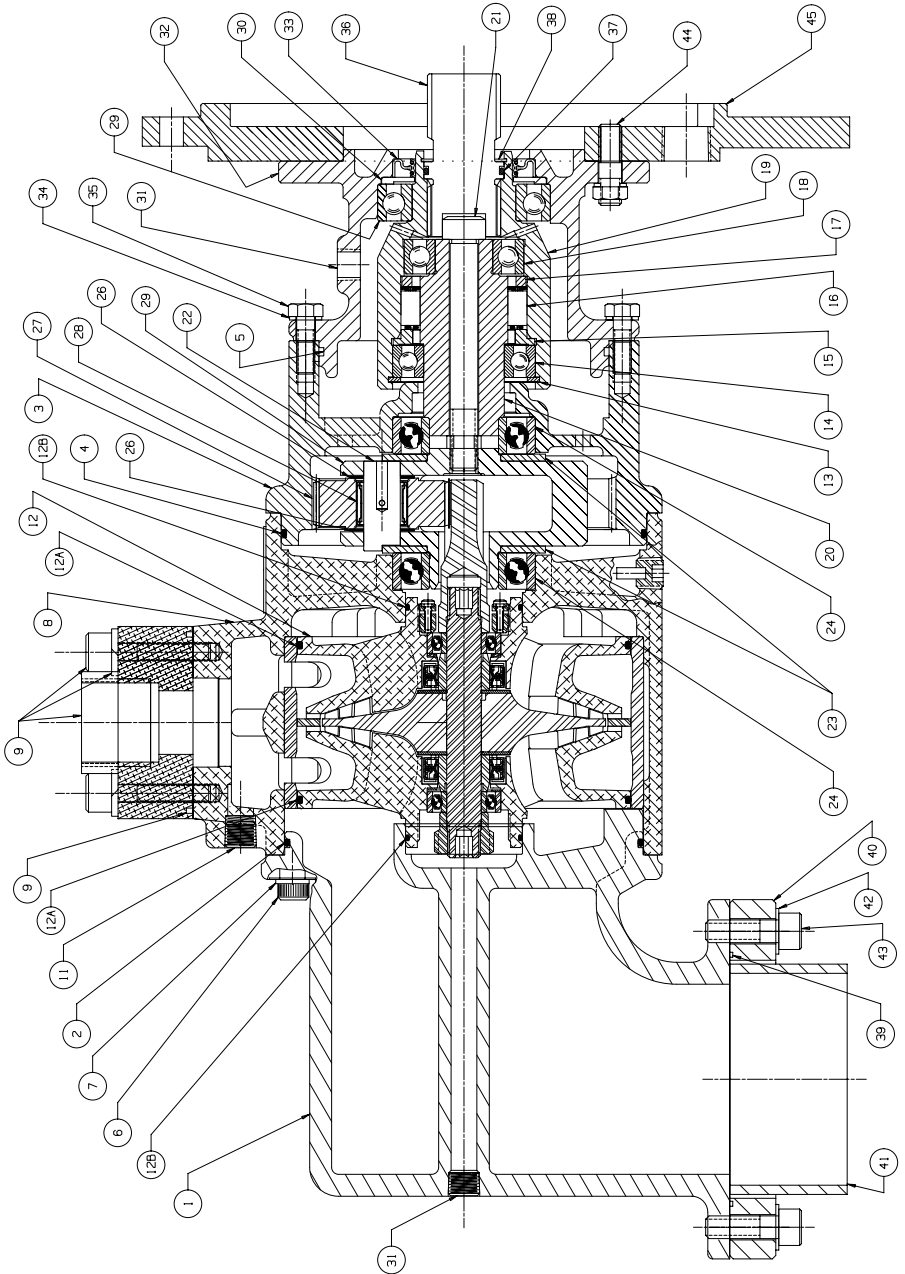
Parts Information

TS700 Turbine Powered Starter - Section View



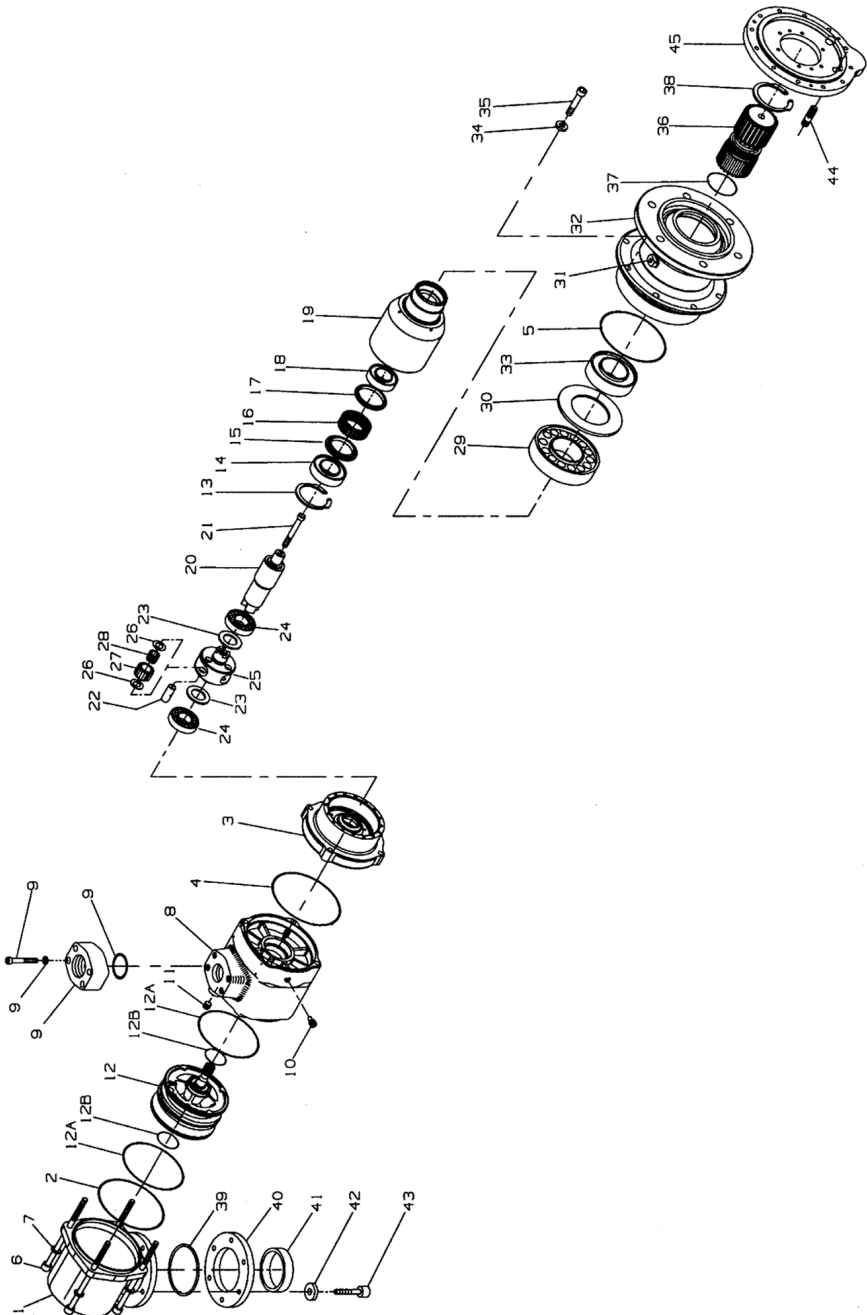


TS700 Turbine Powered Starter - Section View



(Dwg. TPA1463)

TS700 Turbine Powered Starter - Exploded View

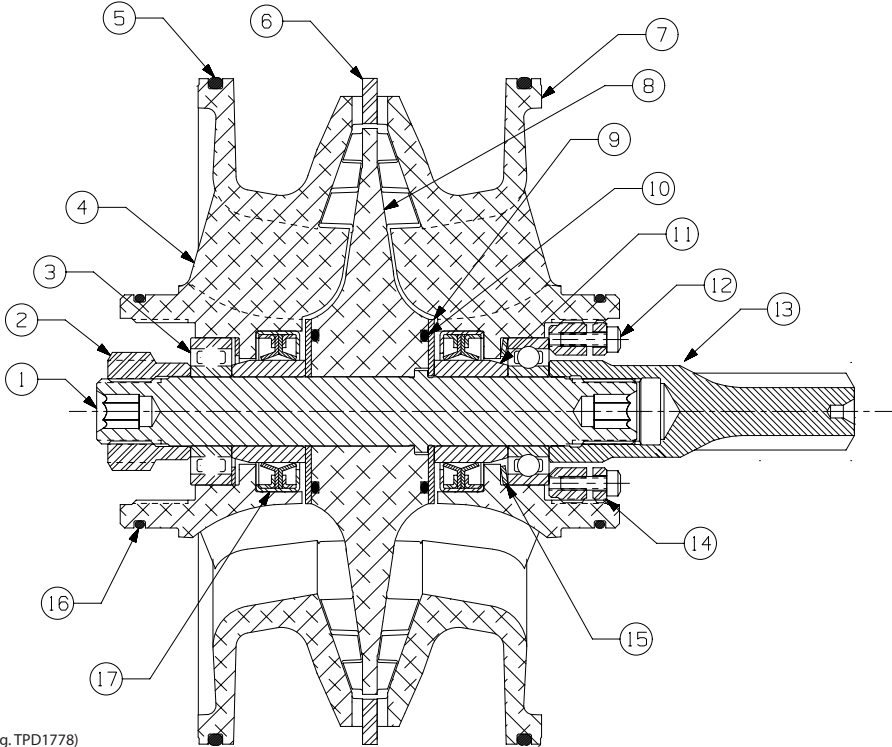


## ST600 Turbine Powered Starter - Parts List

Item	Part Description	Part Number	Item	Part Description	Part Number
	Exhaust Kit	ST700K-350	18	Front Bearing	SS875-278
1	Directional Housing Exhaust		19	Clutch Housing	TS875-14
	Cover	ST700-350	20	Drive Shaft	TS700-85
2	Exhaust Cover Seal	Y327-162	21	Cap Screw	TS700-255
*	Plug	R0H-377	22	Shaft (3)	ST700-191
3	Gear Case	TS700-37B	23	Spacer (2)	TS700-100B
4	Rear Gear Case O-ring	Y327-163	24	Bearing (2)	TA-22
5	Front Gear Case O-ring	Y327-158	25	Frame	
6	Starter Assembly Cap Screw (4)	SS800-25		A Ratio	TS700-108A
7	Cap Screw Washer (4)	SS800-26		B Ratio	TS700-108B
	Motor Housing Assembly	TS725S-A40	26	Spacer (6)	ST700-364
8	Motor Housing	TS725S-40	27	Gear (3)	
9	Inlet Flange Kit (Includes Inlet Flange, Flange Mounting Bolts And Lock Washers)	ST700-K166		A Ratio	TS700-10A
	Sight Glass	TS700-38		B Ratio	TS700-10B
10	Housing Plug (2)	CE110-29	28	Bearing (3)	ST700-363
11	Housing Plug Inlet Boss	R0H-377	29	Bearing	TS700-22
*	Nameplate	ST900-301	30	Spacer	TS700-20
*	Nameplate Screw (4)	R4K-302	31	Pipe Plug (2)	R0H-377
12	Motor Assembly		32	Drive Housing	TS875-300
	For 725 RH Rotation Models		33	Seal	TS700-54
	A Ratio	TS725R-A53A	34	Washer (8)	TE223A-415
	B Ratio	TS725R-A53B	35	Cap Screw (8)	SS800-744
	For 725 LH Rotation Models		36	Splined Shaft A Model	TS710-13A
	A Ratio	TS725L-A53A	36	Splined Shaft B Model	TS710-13B
	B Ratio	TS725L-A53B	36	Splined Shaft C Model	TS710-13C
	For 750 RH Rotation Models		36	Splined Shaft D Model	TS710-13D
	A Ratio	TS750R-A53A	36	Splined Shaft E Model	TS710-13E
	B Ratio	TS750R-A53B	36	Splined Shaft F Model	TS710-13F
	For 750 LH Rotation Models		36	Splined Shaft G Model	TS710-13G
	A Ratio	TS750L-A53A	36	Splined Shaft H Model	TS710-13H
	B Ratio	TS750L-A53B	37	O-ring	Y327-123
	For 799 RH Rotation Models		38	Snap Ring	TS700-16
	A Ratio	TS799R-A53A	39	O-ring	Y327-046
	B Ratio	TS799R-A53B	40	Exhaust Flange	ST700-351
	For 799 LH Rotation Models		41	Weld Sleeve	ST700-352
	A Ratio	TS799L-A53A	42	Lockwashers (6)	845-58
	B Ratio	TS799L-A53B	43	Cap Screw (6)	ST700-703
	12a	Cylinder O-ring Seal (2)	ST700-67	44	Studs (6)
12b	Housing O-ring Seal (2)	Q4032V75	45	B Flange	TS700-300-B
13	Snap Ring	SS875-366	45	C Flange	TS700-300-C
14	Rear Bearing	SS875-399	45	D Flange	TS700-300-D
15	Spacer	SS875-367	45	E Flange	TS700-300-E
16	Clutch	TS700-359	*	Tune-up Kit	TS700-TK1
17	Spacer	TS700-368	*	Rebuild Kit	TS700-RM1

\* Not Illustrated

## Motor Assembly Diagram



(Dwg. TPD1778)

## Motor Assembly Parts List

Item	Part Number	Part Description	Qty.
1	*	Shaft	1
2	*	Nut	1
3	*	Bearing	2
4	*	End Plate	1
5	*	O-ring	2
6	*	Spacer	1
7	*	End Plate	1
8	*	Rotor	1
9	*	Spacer	2
10	*	Seal	2
11	*	Spacer	2
12	*	Screw	2
13	*	Pinion	1
14	*	Nut	1
15	*	Washer	1
16	*	O-Ring	2
17	*	Spring	2

\* These Parts only available as an Assembly.

## Maintenance

### WARNING

Always wear eye protection when operating or performing any maintenance on this starter. Always turn off the air supply and disconnect the air supply hose before installing, removing or adjusting any accessory on this starter or before performing any maintenance on this starter.

## Lubrication

Each time a Series TS700 Starter is disassembled for maintenance or repair, lubricate the starter as follows:

1. Lubricate all o-rings with o-ring lubricant.
2. Add 300 ml (approximately 3/4 pint) of C32 Grade Turbine Oil through the side plug hole in the Motor Housing (8).
3. Wipe both end splines of splined shaft with Ingersoll-Rand No. 130 Grease.
4. Add 15 ml of C32 grade turbine oil at (31) plug in exhaust cover.

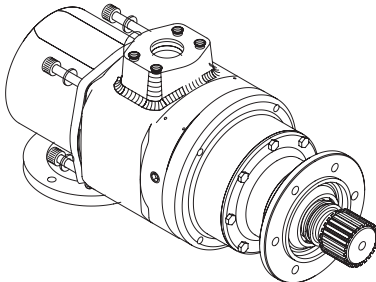
## Disassembly

### General Information

1. Do not disassemble the Starter any further than necessary to replace worn or damaged parts.
2. When grasping a part in a vise, always use coppercovered vice jaws to protect the surface of the part and help prevent distortion. This is particularly true of threaded and die cast members.
3. Do not remove any part which is a press fit in or on a subassembly unless the removal of that part is necessary for replacement or repairs.
4. Always have a complete set of seals and O-rings (TS700TK1) on hand before starting any overhaul of a Series TS700 Turbine Starter. Never reuse old seals or O-rings.
5. Mark adjacent housings so they can be reassembled into the same relative positions with adjacent center punch marks on the out side of the flanges on the Exhaust Cover (1), Motor Housing (8), and Gear Case (3). A quick drying marking pen can be used as an alternative.
6. Do not press any bearing from a part unless you have new bearings on hand for installation. Bearings are always damaged during the removal process.

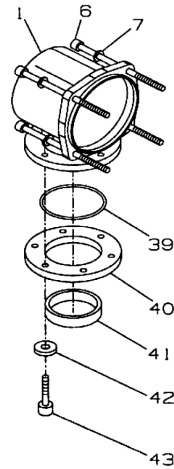
### Housing Exhaust Cover, Motor Assembly, and Motor Housing.

1. If replacing the Motor Assembly (12), remove Housing Plug (10) and drain the oil from the gearing before beginning disassembly of the Starter. Inspect the Magnetic Housing Plugs (10) for metal particles. Very fine metal particles are normal. Remove particles and reinstall plugs. Large particles or chips are an indication of a problem. If apparent, disassemble Gear Case (3) and inspect.
2. Using an 8 mm Hex-head wrench, unscrew and remove the Starter Assembly Cap Screws (6) and Washers (7).
3. Pull the Housing Exhaust Cover (1) from the Motor Housing (8). To dislodge the Housing Exhaust Cover, rotate it until the ears clear the Motor Housing. Using a plastic hammer, tap the ears alternately until the Housing Exhaust Cover can be removed from the Motor Housing. Refer to Dwg. TPD1782.



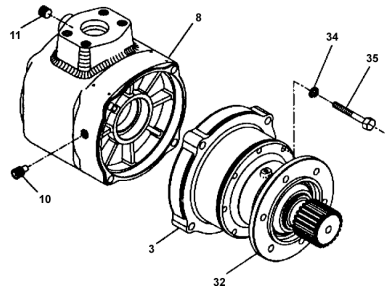
(Dwg. TPD1782)

4. To disassemble the Housing Exhaust Elbow and components. Refer to Dwg. TPD1773.



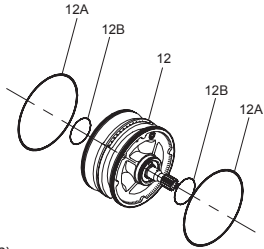
(Dwg. TPD1773)

5. Tap the Motor Housing with a plastic hammer to dislodge it from the Gear Case (3).



(Dwg. TPD1774)

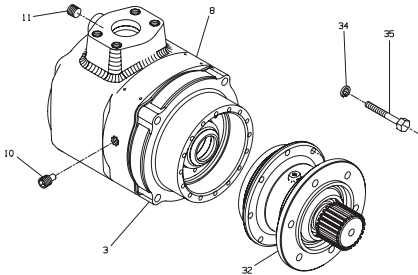
- Grasp the rear of the Motor Assembly (12) and pull from the rear of the Motor Housing. If the Motor Assembly is difficult to remove, lightly, push the motor pinion which is in the front of the Motor Assembly toward the exhaust side of the Motor Housing in order to free the Motor Assembly. The Motor Assembly (12) is replaced as a unit and not disassembled in the field. Refer to Dwg. TPD1783.



(Dwg. TPD1783)

### Drive Housing and Gear Case Disassembly

- Remove the 8 Hex Head Cap Screws (35) that hold the two housings together. Refer to Dwg. TPD1775.



(Dwg. TPD1775)

## Assembly

### Assembly of the Starter

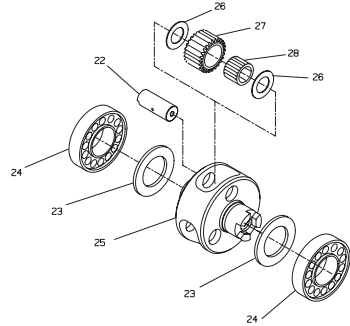
#### General Instructions

- Always press on the inner ring of a ball bearing when installing the bearing on a shaft.
- Always press on the outer ring of a ball bearing when pressing the bearing in a bearing recess.
- Whenever grasping a part in a vise, always use leather-covered, copper-covered vise jaws to protect the surface of the part and help prevent distortion. This is particularly true of threaded and die cast parts.
- Always clean every part, and wipe every part with a thin oil film before installation.
- Note the orientation markings that were placed on the mating flanges before disassembly and assure the assembled unit is arranged as before disassembly.
- Coat all O-rings and the contact surface on their mating parts with o-ring lubricant immediately before assembling those parts.
- When pressing parts together, assure that the parts are located firmly against a shoulder or otherwise positioned as specified.

### Assembly of the Directional Housing Exhaust Cover

- Coat the Exhaust Cover Seal (2) with o-ring lubricant and install in the groove in the Directional Housing Exhaust Cover (1).
- Install Directional Housing Exhaust Cover on the rear of the Motor Housing (8) in the desired orientation and using a plastic hammer, tap the Directional Housing Exhaust Cover until it seats.

- Using two pry bars on opposite sides of the assembly, carefully pry the two housings apart.
- To remove the Splined Shaft (36) from the Clutch Shaft (19), remove Snap Ring (38).
- Using a 10 mm wrench remove the Cap Screw (21) from the Clutch Shaft.
- Remove the clutch assembly from the Gear Case. The clutch assembly is replaced as a unit from the opposite side of the Gear Case and not disassembled any further in the field.



(Dwg. TPD1776)

- Remove the Planet Frame (25). Refer to Dwg. TPD 1776.
- Using a bearing puller remove the two Bearings (24) from the planet frame (25).
- The two Gear Shaft Retaining Washers (23) can be removed from the Planet Frame.
- The three Planet Gear Shafts (22) can be pushed from the planet frame.

### CAUTION

This will free for removal the Planet Gears (27), the Bearing Spacers (26), and the Needle Rollers (28).

- Secure the Directional Housing Exhaust Cover on the rear of the Motor Housing using the Starter Assembly Cap Screws (6) and Cap Screw Washers (7). Using an 8mm hex-head wrench, tighten each Cap Screw a little at a time to a final torque of 55 ft-lb (74.5 Nm) in 20 ft-lb (27 Nm) increments. Refer to Dwg. TPD1782.
- Lubricate Exhaust Adapter Seal (39) with o-ring lubricant and install in groove in Exhaust Flange.

### NOTICE

Use Loctite® 56747 \*\*Pipe Sealant on all plugs.

- Place the starter in a vertical position with Exhaust Elbow Plug (31) up. Pour 15 ml of C32 Grade Turbine Oil and replace Plug.
- Install the bottom Housing Plug (10) with Loctite® 56747 and the Housing Plug Inlet Boss (11). Put the Starter on its side with the side plug hole upward. Add 300 ml (approximately 3/4 pint) of C32 Grade Turbine Oil through the side plug hole in the Motor Housing (8).

### NOTICE

Change oil annually or every 500 starts.

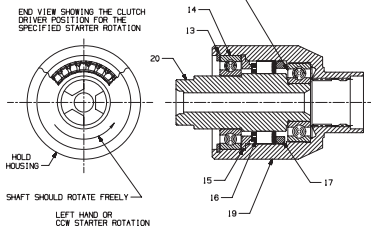
\*\* Registered trademark of Loctite Corporation.

## Clutch Assembly

### NOTICE

The Clutch should be replaced after 1500 starts.

1. Press the Front Clutch Bearing (18) onto the Drive Gear Shaft (20).
2. Insert the Shaft Bearing Assembly into the Clutch Housing (19). If necessary, tap into position with a plastic hammer using the correct adapter.
3. With the Clutch Shaft in a vertical position, insert in sequence, Spacer (17), the Clutch (16), and Spacer (15). For opposite rotation units (right hand or counter clockwise starter rotation), reverse the clutch orientation from that shown in Dwg. TPD1793.



(Dwg. TPD1793)

4. Using a 28 mm maximum diameter Gear Shaft support which extends through the splined end of the Clutch Shaft, carefully press the Rear Clutch Bearing (14) into place.
5. Install the Retaining Ring (13) into the groove in the Clutch Shaft.
6. Press the Bearing onto the Clutch Shaft (20) so that it seats against the shoulder on the shaft.

## Gear Case Assembly

1. Assemble Gear Shaft Retaining Washer (23) onto end of Planet Frame opposite the driving dogs. The counterbored side of the Washer must be towards the Planet Frame.
2. Press Bearing (24) onto Planet Frame so that it seats against the Washer.
3. Hold the end of the Planet Gear Shaft (22) in a leather covered or copper covered vice jaws. Place a Bearing Spacer (26) over the Shaft. Lay a fillet bed of Ingersoll-Rand No. 100 grease around the Shaft and Spacer. Place Planet Gear (27) over the Shaft and seat onto the grease. Insert eighteen pieces of Needle Rollers (28) between the Shaft and Gear. Add a fillet of Grease over the end of the Rollers and seat a Bearing Spacer over the Shaft.
4. Carefully lift the assembly of two Spacers, Gear and Rollers from the Shaft and slide it onto the Planet Frame so that the holes line up.
5. Remove the Shaft from the vise, holding it by the plain end, and position it so that the step on the opposite end lines up with the Retaining Washer on the opposite side of the Planet Frame. Slide it into the Planet Frame, through the Gear and Spacer Pack, and through the opposite side of the Planet Frame. Tap lightly with a plastic hammer if necessary. Repeat this procedure for each Planet Gear.

6. Place a Gear Shaft Retaining Washer (23) on the driving dog end of the Planet Frame. The counterbored side of the washer must face the Planet Frame.
7. Press the Planet Frame Bearing (24) onto the Planet Frame so that it seats against the washer.
8. Press Shaft Seal (33) into the front of the Drive Housing (32). The metal case of the Seal must enter the housing first.
9. Place the Motor Housing Assembly in a vertical position with the Gear Case end up. Assemble the Planet Gear Frame by fitting the Bearing (24) into the bore in the Motor Housing.
10. Assemble the O-ring (4) onto the Gear Case. (3).
11. Carefully set the Gear Case down over the Planet Frame Assembly and onto the Motor Housing. Rotate the Gear Case slightly as needed to engage the Planet Gear Teeth into the internal Gear in the Gear Case. Rotate the Gear Case onto the indicated orientation and tap into position with a plastic hammer.
12. Lay the assembly on its side and thread the Starter Assembly Capscrews (6) with Lockwashers (7) into the four holes. Alternately tighten the screws to 50 ft.-lb. (68 Nm) in 10-15 ft.-lb. (16 Nm) increments.
13. Assemble the Clutch Assembly into the Planet Frame. Make sure that the driving dogs on the Planet Frame mesh with the driving dogs on the Drive Gear Shaft.
14. Insert the Screw (21) with Loctite 242 through the Drive Gear Shaft and thread onto the Planet Frame. Tighten to 90 ft.-lb. torque (122 Nm). For right hand rotation, hold the Clutch Shaft with a strap type wrench.
15. Assemble the O-ring (5) onto the Drive Housing (32).
16. Carefully lower the Drive Housing down over the Clutch Assembly onto the face of the Gear Case being careful not to damage the top of the Housing Seal. After the seal has been positioned onto the Clutch Shaft, the Drive Housing can be tapped onto place with a plastic hammer.
17. After positioning the Drive Housing to the orientation marks, thread the eight Capscrews (35) and Lockwashers (34) into the tapped holes in the Gear Case. Tighten the cap screws to 28 ft.-lb. (38 Nm) torque.
18. Assemble the O-ring (37) onto the Splined Shaft (36). Carefully insert it into the Clutch Shaft. Tap into place with a plastic hammer. Insert the Snap Ring (38) into the Clutch Shaft (19).

## Test and Inspection Procedure

1. Turn the Splined Shaft by hand in the direction of starter rotation. It should turn freely and easily.
2. Turn the Shaft in the opposite direction. It will be more difficult to turn; however, it should turn smoothly with no binding. Turn the shaft through 12 to 15 revolutions.
3. Confirm orientation by referring through to previously placed markings or installation drawing.
4. Secure starter in a vise and apply 90 psi (6.2 BAR/620kPa) pressure using a 3/8" (9 mm) supply line to the inlet of the motor. The starter should run smoothly. Confirm that the Splined Shaft is turning in the correct direction. If applicable, confirm that the exhaust deflector returns to its normal position after the air is turned off.
5. With the starter immersed in a non-flammable, bubbleproducing liquid, slowly apply 20 psi (1.38 Bar/138 kPa) to the inlet of the motor for 30 seconds. No bubbles should appear.

## Troubleshooting Guide

Trouble	Probable Cause	Solution
Motor will not run	No air supply.	Check for blockage or damage to air supply lines or tank.
	Damaged Motor Assembly (12)	Inspect Motor Assembly and power train and repair power train or replace Motor Assembly if necessary.
	Foreign material in Motor and/or piping	Remove Motor Assembly and/or piping and remove the blockage.
	Blocked exhaust system.	Remove Housing Exhaust Cover (1) and check for blockage.
	Defective Control Valve or Relay Valve.	Replace Control Valve or Relay Valve.
Loss of Power	Low air pressure to Starter.	Check air supply.
	Restricted air supply line.	Check for blockage or damage to air lines.
	Relay Valve malfunctioning.	Clean or replace lines or Relay Valve. Lubricate Relay Valve.
	Exhaust flow restricted.	Check for blocked or damaged piping. Clean or replace piping. Check for dirt or foreign material and clean or remove. Check for ice build-up. Melt ice and reduce moisture build-up to Starter.
	Damaged Motor Assembly.	Replace Motor Assembly.
Oil blowing out of exhaust	Oil in air supply line.	Inspect air line and remove source of oil.
	Splash Deflector Retaining Screw (31) or pipe plug missing.	Install Splash Deflector Retaining Screw or pipe plug.
	Worn or damaged rotor seals or static O-Rings.	Replace static seals on outside of Motor or send Motor to Ingersoll-Rand to be rebuilt.
Oil leaking from Gear Case	Worn or damaged O-Rings.	Replace O-Rings.
	Loose joints.	Make sure that joints fit properly and Starter Assembly Cap Screws are tightened to 60 ft-lb (81 Nm) torque. Make sure all seals and O-Rings fit and seal properly at their perimeters. If they do not, replace with new seals and O-Rings.
	Excessive high-speed operation.	Operate according to recommendations.
	High number of start cycles.	Replace worn components.
	Loose or leaking Pipe Plugs (31) (11).	Tighten or replace Pipe plugs using Ingersoll-Rand SMB-441 Pipe Sealant.
	Splash Deflector Retaining Screw or pipe plug missing.	Tighten Splash Deflector Retaining Screw or replace pipe plug.
Air or gas leakage	Loose Joints.	Make sure that joints fit properly and that Starter Assembly Cap Screws are tightened to 60 ft-lb (81 Nm) torque. Make sure that all seals and ORINGS fit and seal properly at their perimeters. If they do not, replace with new seals and O-Rings.
	Excessive high-speed operation	Operate according to recommendations.
	High number of start cycles	Replace worn components.
	Loose or leaking Pipe Plugs	Tighten or replace pipe plugs.
	Splash Deflector Retaining Screw loose or pipe plug missing	Tighten Splash Deflector Retaining Screw or replace pipe plug.



## TS700 Maintenance Schedule

Starts	Components	Recommendation
500	C3 Turbine Oil	Change
500	All External Cap Screws	Check Torque
500	Strainer	Check Element
1000	C3 Turbine Oil	Change
1000	All External Cap Screws	Check Torque
1000	Strainer	Check Element
1500	C3 Turbine Oil	Change
1500	All External Cap Screws	Check Torque
1500	Strainer	Check Element
1500	Clutch, TS700-359	Change
1500	Rear Bearing, SS875-399	Change
1500	Front Bearing, SS875-278	Change
1500	Seal, TS700-54	Change
1500	O-ring, Y327-158	Change
1500	O-ring, Y327-123	Change
1500	Bearing, TS700-22	Change
2000	C3 Turbine Oil	Change
2000	All External Cap Screws	Check Torque
2000	Strainer	Check Element
2500	C3 Turbine Oil	Change
2500	All External Cap Screws	Check Torque
2500	Strainer	Check Element
3000	C3 Turbine Oil	Change
3000	Clutch, TS700-359	Change
3000	All External Cap Screws	Check Torque
3000	Strainer	Check Element
3000	Rear Bearing, SS875-399	Change
3000	Front Bearing, SS875-278	Change
3000	Seal, TS700-54	Change
3000	O-ring, Y327-158	Change
3000	O-ring, Y327-123	Change
3000	Bearing, TS700-22	Change
3500	C3 Turbine Oil	Change
3500	All External Cap Screws	Check Torque
3500	Strainer	Check Element

## Parts and Maintenance

### CAUTION

The use of other than genuine Ingersoll Rand replacement parts may result in safety hazards, decreased motor performance, and increased maintenance, and may invalidate all warranties.

**Ingersoll Rand is not responsible for customer modification of Starters for applications on which Ingersoll Rand was not consulted. Repairs should be made only by authorized trained personnel. Consult your nearest Ingersoll Rand Authorized Service center.**

When the life of the Starters has expired, it is recommended that the Starters be disassembled, degreased and parts be separated by material so that they can be recycled.

Manuals can be downloaded from [ingersollrandproducts.com](http://ingersollrandproducts.com)

Refer all communications to the nearest **Ingersoll Rand** Office or Distributor.

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**Notes:**

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