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ENGINE STARTING SYSTEMS

IT ALL STARTS WITH INGERSOLL RAND

For over a half century, Ingersoll Rand has delivered the most reliable air starters for use in the world's most demanding industries and environments.

LEADER IN AIR STARTING

broad line of turbine starters, vane starters and barring motors

BEST-IN-CLASS PERFORMANCE

horsepower, torque and efficiency

CULTURE OF INNOVATION

latest technology and superior engineering

LAB TESTED, FIELD PROVEN

rugged components ensure reliability in harsh conditions

GLOBAL SUPPORT

worldwide sales, service and engineering

We invite you to peruse our catalog, learn more about our wide range of products and discover for yourself why the biggest names in the business trust Ingersoll Rand air starters.

INTERNATIONAL CERTIFICATIONS

ISO 9001:2000 – ABS (American Bureau of Shipping) – Lloyd's Register Germanischer Lloyd (www.germanlloyd.org)

Certificate information available upon request.



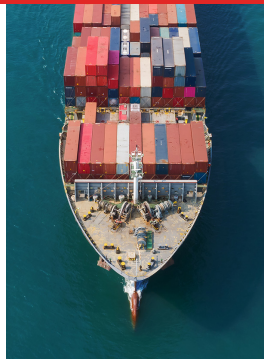
Catalog pages with this symbol describe Ingersoll Rand products specified as "original equipment" by global engine manufacturers.

SELECTION GUIDE

AIR STARTER INDUSTRY SELECTION GUIDE



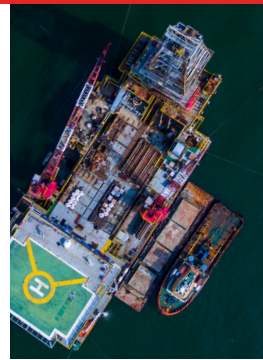
Locomotive



Marine



Off-highway



Oil and Gas



Power generation



Mining

TURBINE STARTERS

	Locomotive	Marine	Off-highway	Oil and Gas	Power generation	Mining
ST150 Series	X	X	X	X	X	X
ST400		X			X	
ST500		X	X	X	X	
ST600		X	X		X	X
ST700/ST900	X	X	X	X	X	
ST1000/ST1000M	X	X	X	X	X	X

VANE STARTERS

SS100		X	X	X	X	X
SS350		X	X	X	X	X
150BM		X	X	X	X	X
SS800		X	X	X	X	X

GAS TURBINE STARTERS

TS700/TS900/TS1400				X	X	
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BARRING MOTORS

B006	X	X	X	X	X	X
T480	X	X	X	X	X	X

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HIGH-PERFORMANCE FROM START TO FINISH

TURBINE STARTERS



Patented slip-fit, modular motor design makes servicing simple and convenient.

From the remotest mines to the open seas, Ingersoll Rand turbine air starters withstand the toughest environmental and working conditions. Robust features and flexibility combine to deliver reliable, heavy-duty starting power for a wide range of industrial, oil and gas, marine, power generation, rail and mining applications.

Unlike cantilever designs, our fully-supported, high-speed rotors extend bearing life by minimizing deflection and ensuring concentric operation. Add in our lightweight, lube-free and field-serviceable motor design and it's no wonder Ingersoll Rand turbine air starters are specified by premier engine OEMs across the globe.

- Lube-free turbine motor
- Easy field serviceability
- Robust gearing handles long crank cycles
- Fully-supported rotor for longer bearing life
- Sealed, oil-lubricated planetary sets (preferred worldwide for high-performance gear trains)
- Solid aluminum rotor design tames harsh, contaminated environments*
- Modular motor design shares components with vane starters to reduce parts inventory
- Proven Ingersoll Rand front-end engagement system for greater reliability
- Class-leading power, durability and efficiency

* ST1000 Series



TURBINE STARTERS

TURBINE STARTER SELECTION GUIDE (LUBRICATION FREE) SPECIFICATIONS

For Diesel Engine Displacement (liters)	Catalog Pages	Series	Gear Ratio	Extended Starting Capability (>10 sec.)	Max Power (HP)	Max Pressure psi (bar)	Air Consumption at Max HP scfm (L/s)	Engagement Type**	Inlet Size (NPT)	Exhaust Size (NPT)	Gas Sealed
8 to 27	7-9	150TMG	F	Yes	28	150 (10.3)	710 (335)	Inertia	1 1/4"	2"	Yes
8 to 27	7-9	150TMP	F	Yes	28	150 (10.3)	710 (335)	Pre-Engaged	1 1/4"	2"	Yes
8 to 70	7-9	150TLP	F	Yes	28	90 (6.2)	780 (368)	Pre-Engaged	1 1/4"	2"	Yes
5 to 60	10-11	ST400	C	Yes	25	150 (10.3)	750 (354)	Pre-Engaged	1"	NA	No
5 to 60	10-11	ST455	C	Yes	23	120 (8.3)	780 (368)	Pre-Engaged	1"	NA	No
5 to 60	12-14	ST499	C	Yes	26	90 (6.2)	765 (361)	Pre-Engaged	1"	NA	No
5 to 100	12-14	ST599	F	Yes	44	150 (10.3)	1240 (585)	Pre-Engaged	1 1/4"	2"	Yes
5 to 100	15-16	ST544	F	Yes	28	150 (10.3)	710 (335)	Pre-Engaged	1 1/4"	2"	Yes
16 to 80	15-16	ST650	B	Yes	66	150 (10.3)	1450 (684)	Pre-Engaged	1 1/4"	5" V-Band Flange	No
16 to 80	15-16	ST699	B	Yes	67	90 (6.2)	1700 (802)	Pre-Engaged	1 1/2"	5" V-Band Flange	No
16 to 130	17-20	ST750/ ST950	B	No/Yes	55	150 (10.3)	1300 (614)	Inertia/ Pre-Engaged	1 1/2"	4" *	Yes
16 to 130	17-20	ST799/ ST999	B	No/Yes	66	90 (6.2)	1700 (802)	Inertia/ Pre-Engaged	1 1/2"	4" *	Yes
80 to 200	17-20	ST750/ ST950	C	No/Yes	55	150 (10.3)	1300 (614)	Pre-Engaged	1 1/2"	4" *	Yes
80 to 200	17-20	ST799/ ST999	C	No/Yes	66	90 (6.2)	1700 (802)	Pre-Engaged	1 1/2"	4" *	Yes
16 to 130	21-24	ST1060	B	Yes	70	150 (10.3)	1290 (609)	Inertia/ Pre-Engaged	1 1/2"	4" *	Yes
16 to 130	21-24	ST1099	B	Yes	68	90 (6.2)	1240 (585)	Inertia/ Pre-Engaged	1 1/2"	4" *	Yes
80 to 200	21-24	ST1060	C	Yes	70	150 (10.3)	1290 (609)	Pre-Engaged	1 1/2"	4" *	Yes
80 to 200	21-24	ST1099	C	Yes	68	90 (6.2)	1240 (585)	Pre-Engaged	1 1/2"	4" *	Yes
160 to 320	21-24	ST1060	D	Yes	70	150 (10.3)	1290 (609)	Pre-Engaged	1 1/2"	4" *	Yes
160 to 320	21-24	ST1099	D	Yes	68	90 (6.2)	1240 (585)	Pre-Engaged	1 1/2"	4" *	Yes
Gas Turbine Engines	39-44	TS700/ TS900	D	Yes	130	225 (15.5)	2200 (1038)	Permanently Engaged	1 1/2"	4" *	Yes

* Or exhaust through a welded flanged 3 1/2" schedule 40 pipe.

These figures are only a guide. For difficult-to-start engines or for operation under adverse conditions, use the next more powerful starter. For 2-stroke diesel engines, these figures may be multiplied by 1.5. Ex: a 150TMG could be used in a 41 liter 2-stroke diesel engine. For carbureted (gas) engines, these figures may be doubled. Ex: a 150BMP could be used on a 54 liter gasoline engine. Note 1 liter = 61.02 in³.

** There are two basic types of air starters: pre-engaged and inertia. With pre-engaged starters, the drive pinion is completely engaged with the engine ring gear before the starter begins to crank the engine. With an inertia starter, the rotating drive pinion engages the engine ring gear simultaneously with the initial cranking of the engine.

TURBINE STARTERS

ST150 SERIES



For engine displacement of:

Diesel—500 to 4300 CID
(8 to 70 liters)

Carbureted—1000 to 8600
CID (16 to 140 liters)

FEATURES/BENEFITS

- Efficient 47 HP turbine motor uses no external lubrication
- Same inlet and outlet locations as the 150BM Series starters for easy change-out
- Uses the proven front end of the 150BM starter
- Sealed, oil-lubricated planetary gears provide maintenance-free operation

VERSATILE

- Sealed for use in gas and air applications
- Inertia and pre-engaged models
- Left- and right-hand rotation
- 4 inlet, 4 exhaust, and 16 drive housing orientations
- 30-150 psi (2.1-10.3 bars) operation

INDUSTRY APPLICATIONS



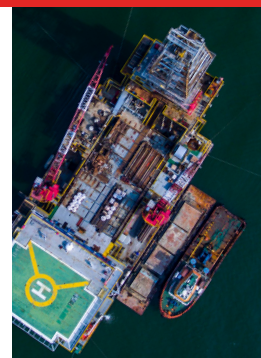
Locomotive



Marine



Off-highway



Oil and Gas



Power generation



Mining

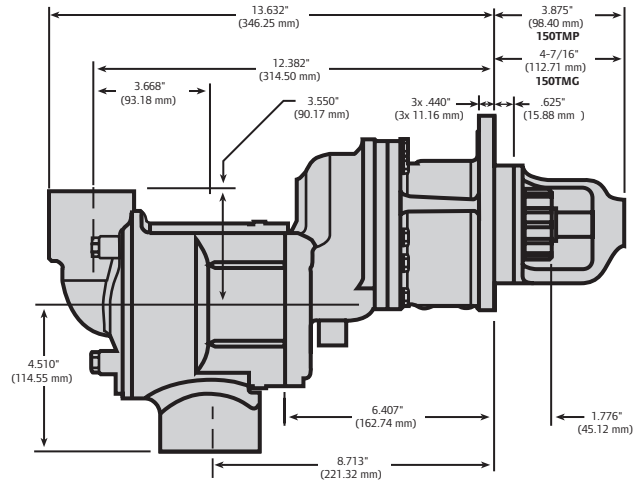
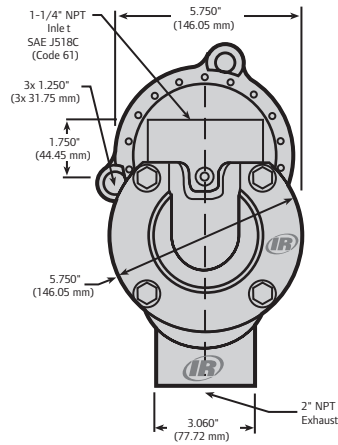
TURBINE STARTERS

ST150 SERIES

DIMENSIONS

Weight: 38 lbs (17.2 kg)

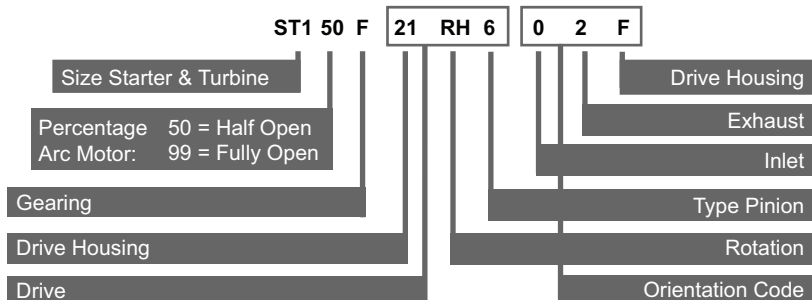
Note: All dimensions shown are for reference only. Specifications subject to change without notice.



PERFORMANCE INFORMATION

Pressure psi (bar)	Breakaway Torque ft-lb (Nm)	Speed @ Max HP	Max Power HP (kW)	Flow @ Max HP scfm (L/s)
ST155 PERFORMANCE INFORMATION				
60 (4.1)	100 (136)	1675	16 (12)	415 (196)
90 (6.2)	150 (203)	1825	26 (19)	580 (274)
120 (8.3)	200 (271)	1950	37 (28)	745 (352)
150 (10.3)	240 (325)	2050	47 (35)	905 (427)
ST159 PERFORMANCE INFORMATION				
30 (2.1)	60 (81)	1465	8 (6)	315 (149)
60 (4.1)	125 (169)	1788	21 (16)	520 (245)
90 (6.2)	190 (258)	1938	35 (26)	725 (342)
120 (8.3)	240 (325)	2050	47 (35)	920 (434)

MODEL CODING














Simple Crossover

Example: 150BMPE88R54 = ST155FP88R54

TURBINE STARTERS

ST150 SERIES

PARTS AND ACCESSORIES

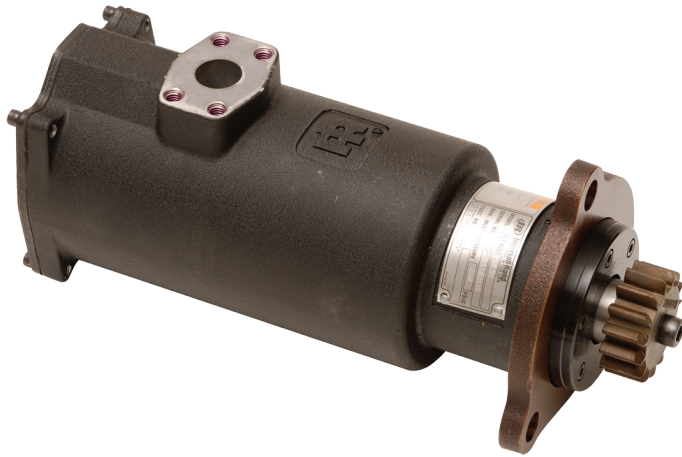
	Part Number	Description		Part Number	Description
	ST500-674 or 150T-312	2" Muffler		150BMP-1064	1/8", 150 psi Pressure Gauge
	150BMP-1051B	1/4" 12 V Solenoid Valve		ST1000-267-24	1 1/2" Strainer Housing
	150BMP-2451B	1/4" 24 V Solenoid Valve		ST1000-266-24	1 1/2" Strainer (50 microns)
	SMB-G618	Gas Rated Push Button Valve		ST500-A735	2" Road Splash Deflector
	SMB-618	Push Button Valve		150BMP-1056	1/2" Check Valve
	SRV125F	1 1/4" Relay/Solenoid Valve		ST500-K166	SAE J518 Split Flange
	SRV125T	1 1/4" Relay Valve for Transit Aftermarket			
	SRV125	1 1/4" Relay Valve for Stationary Air			
	SRV150SS	1 1/2" Gas Rated Relay Valve			

GENUINE INGERSOLL RAND REPLACEMENT KITS

Tune Up Kit Part Number	Description
ST150FP-TK1	ST150 Pre-engaged Starter Tune Up Kit
ST150DP-TK1	ST150 Starter Tune Up Kit

TURBINE STARTERS

ST400 SERIES



FEATURES/BENEFITS

- Efficient 26 HP turbine motor uses no external lubrication
- One-hose hookup simplifies required piping
- In-line design weighs only 23 lbs (10.4 kg)
- Sealed grease fill lubrication for gears and bearings provides maintenance-free operation

VERSATILE

- Removable mounting flange can be rotated 360 degrees for greater mounting flexibility
- Compact, lightweight design makes installation easy
- Overhung pinion design fits most worldwide manufacturers' engines
- 60-150 psi (4.1-10.3 bars) operation

MODEL CODING

ST400 I C 03 R 31

ST400 - 44% ARC
(Max. 150 PSI)

ST455 - 55% ARC
(Max. 120 PSI)

ST499 - 99% ARC
(Max. 90PSI)

I - 1" NPT
No Letter - Sales Split Flange

C - Gear Ratio

Pinion Code

R - Right Hand
L - Left Hand

01 - SAE 1 Flange
03 - SAE 3 Flange



For engine displacement of:

Diesel-300 to 3600 CID
(5 to 60 liters)

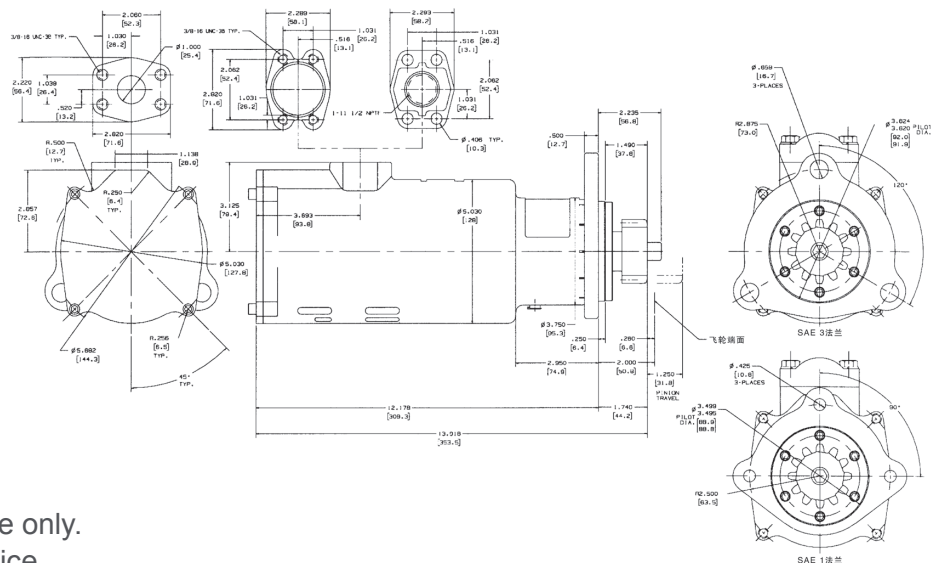
INDUSTRY APPLICATIONS



Marine



Power generation



DIMENSIONS

Weight: 23 lbs (10.4 kg)

Note: All dimensions shown are for reference only.
Specifications subject to change without notice.










TURBINE STARTERS

PERFORMANCE INFORMATION

Pressure psi (bar)	Breakaway Torque ft-lb (Nm)	Speed @ Max HP rpm	Max Power HP (kW)	Flow @ Max HP scfm (L/s)
ST400 – 44% ARC				
90 (6.2)	90 (122)	1500	14 (10)	430 (203)
120 (8.3)	120 (163)	1650	19 (14)	600 (284)
150 (10.3)	150 (203)	1650	25 (19)	750 (354)
ST455 – 55% ARC				
60 (4.1)	80 (109)	1400	10 (7)	23 (17)
90 (6.2)	135 (183)	1450	18 (13)	650 (307)
120 (8.3)	185 (251)	1500	23 (17)	780 (368)
ST499 – 99% ARC				
60 (4.1)	115 (156)	1600	14 (10)	550 (260)
90 (6.2)	185 (251)	1650	26 (19)	765 (361)

PARTS AND ACCESSORIES

	Part Number	Description
	150BMP-1051B	1/4" 12 V Solenoid Valve
	150BMP-2451B	1/4" 24 V Solenoid Valve
	SMB-618	Push Button Valve
	SRV125F	1 1/4" Relay/Solenoid Valve
	SRV125T	1 1/4" Relay Valve for Transit Aftermarket
	SRV125	1 1/4" Relay Valve for Stationary Air
	SRV150	1 1/2" Relay Valve
	ST400-K17	1" NPT Flange Kit
	ST400-16	SAE J518 Split Flange

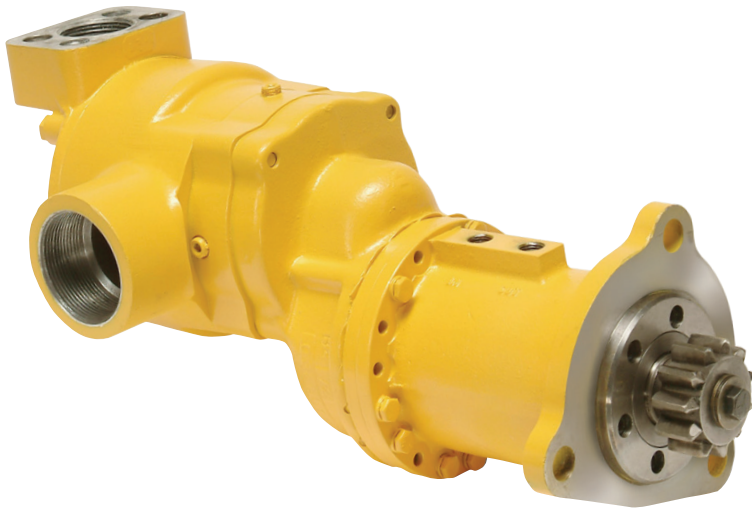
GENUINE INGERSOLL RAND REPLACEMENT KITS

Tune Up Kit Part Number	Description
LINER ASSEMBLY	
ST400-A41R	Standard Arc Right Hand
ST400-A41L	Standard Arc Left Hand
ST455-A41R	55% Arc Right Hand
ST455-A41L	55% Arc Left Hand
ST499-A41R	Full Arc Right Hand
ST499-A41L	Full Arc Left H

*For complete filter (strainer + housing), please order ref ST900-267/150-HP

TURBINE STARTERS

ST500 SERIES



For engine displacement of:
Diesel—500 to 6000 (8 to 100 liters)
Carbureted—1000 to 12,000 CID
(16 to 200 liters)

FEATURES/BENEFITS

- Powerful 44 HP turbine motor uses no external lubrication
- Steel insert at inlet ensures a solid connection
- Smooth pre-engagement piston minimizes ring gear wear
- Sealed, oil-lubricated planetary gears provide maintenance-free operation

VERSATILE

- Sealed for use in gas and air applications
- For use with air or natural gas
- 4 inlet, 4 exhaust, and 16 drive housing orientations
- Left- or right-hand rotation
- Optional pinions and flanges to fit most engines
- 30-150 psi (2.1-10.3 bars) operation

INDUSTRY APPLICATIONS



Marine



Off-highway



Oil and Gas



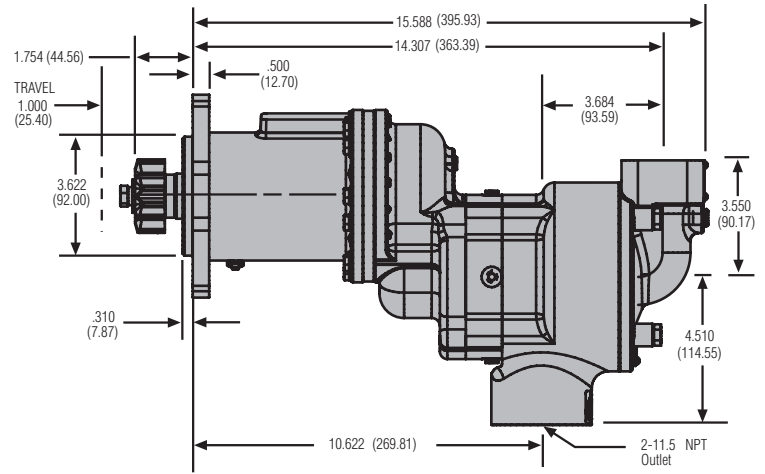
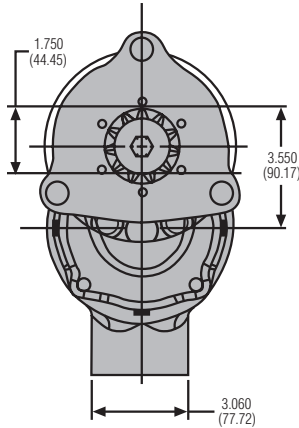
Power generation

TURBINE STARTERS

DIMENSIONS

Weight:
38 lbs (17.2 kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.

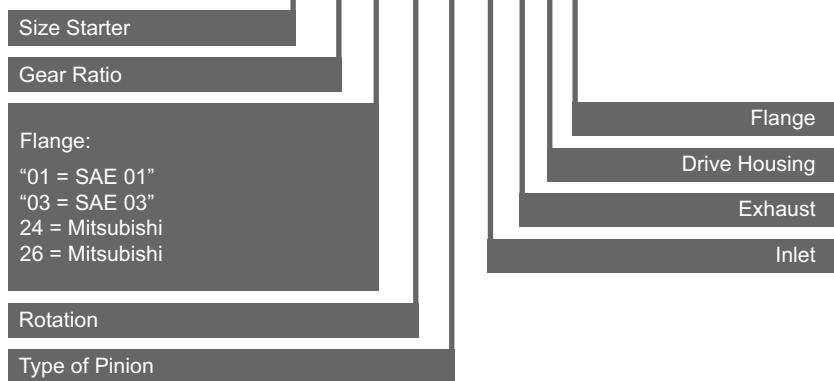


PERFORMANCE INFORMATION

Pressure psi (bar)	Breakaway Torque ft-lb (Nm)	Speed @ Max HP rpm	Max Power HP (kW)	Flow @ Max HP scfm (L/s)
ST544				
60 (4.1)	74 (100)	1296	9 (7)	310 (146)
90 (6.2)	113 (153)	1480	16 (12)	430 (203)
120 (8.3)	147 (200)	1580	22 (17)	600 (284)
150 (10.3)	182 (247)	1620	28 (21)	750 (354)
ST599				
30 (2.1)	72 (98)	1185	8 (6)	340 (160)
60 (4.1)	132 (179)	1500	19 (14)	580 (274)
90 (6.2)	206 (280)	1530	30 (23)	780 (368)
120 (8.3)	247 (336)	1540	36 (46)	1000 (475)
150 (10.3)	295 (400)	1560	44 (58)	1240 (585)

MODEL CODING





ST544 F 03 R 25 0 2 F J



TURBINE STARTERS

PARTS AND ACCESSORIES

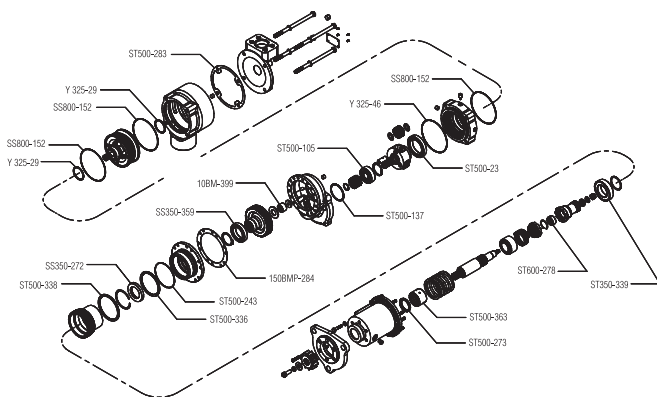
	Part Number	Description
	150BMP-1051B	1/4" 12 V Solenoid Valve
	SMB-G618	Gas Rated Push Button Valve
	SMB-618	Push Button Valve
	SRV125T SRV125	1/4" Relay Valve for Transit Aftermarket 1/4" Relay Valve for Stationary Air
	150BMP-1064	1/8", 150 psi Pressure Gauge
	ST500-A735	2" Road Splash Deflector

	Part Number	Description
	ST500-K166	SAE J518 Split Flange
	150BMP-1056	1/2" Check Valve
	150T-312	2" Muffler
	SMB-441	Liquid Sealant
	ST1000-267-24	1 1/2" Strainer Housing
	ST1000-266-24	1 1/2" Strainer (40 mesh)

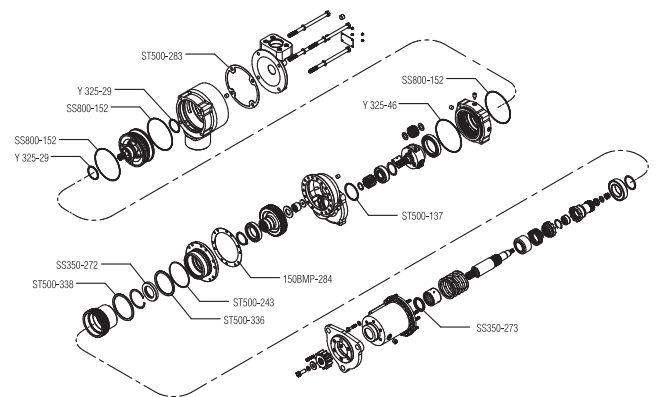
GENUINE INGERSOLL RAND REPLACEMENT KITS

Tune Up Kit Part Number	Description
ST500-TK1	ST500 Starter Tune Up Kit

Tune Up Kit Part Number	Description
ST500-SK1	ST500 Seal Kit



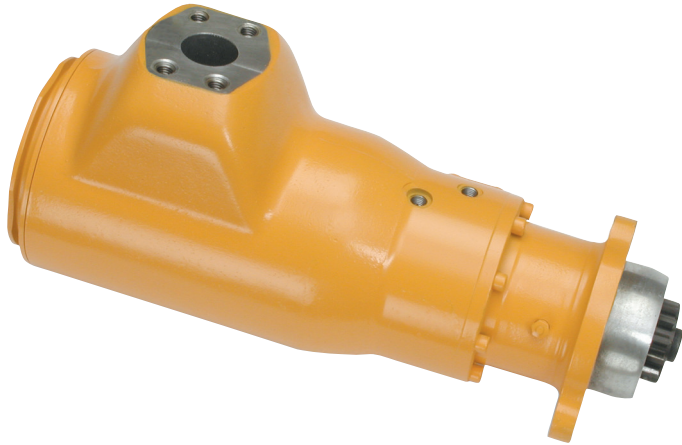
Exploded View of ST500-TK1 Part Location



Exploded View of ST500-SK1 Part Location

TURBINE STARTERS

ST600 SERIES



FEATURES/BENEFITS

- Powerful 67 HP turbine motor uses no external lubrication
- Extended pilot for easier installation
- Offset pre-engaged ports for greater fitting positioning
- Smooth pre-engagement for limited ring gear wear
- 39 lb (17.7 kg) weight makes it one of the lightest starters in its class

VERSATILE

- In-line design and light weight make installation easy
- Left- or right-hand rotation
- 8 orientation options
- 30-150 psi (2.1-10.3 bars) operation
- For use with air only



For engine displacement of:
Diesel—1000 to 5000 CID (16 to 80 liters)

Carbureted—2000 to 10,000CID
(32 to 160 liters)

INDUSTRY APPLICATIONS



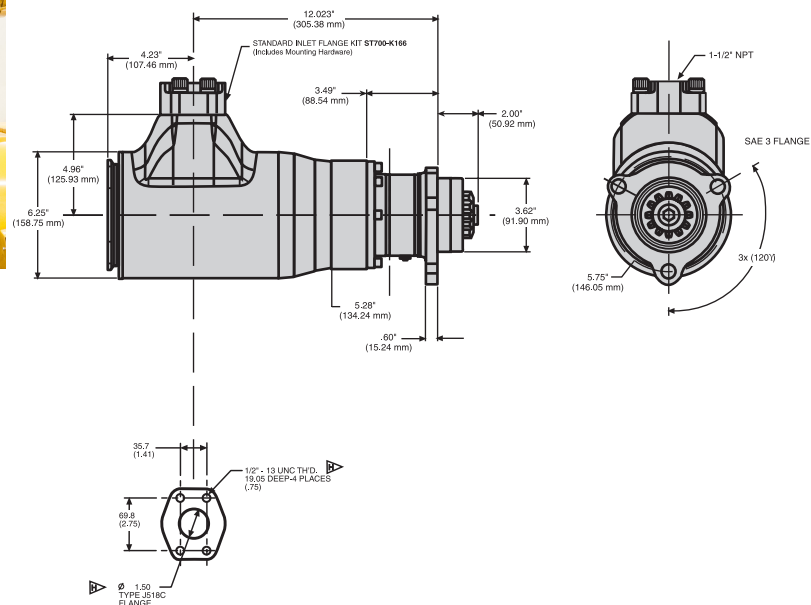
Marine



Off-highway



Power generation



DIMENSIONS

Weight: 39 lbs (17.7 kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.

Inlet Flange Kit (ST700-K166)

Weight: 4.5 lbs (2.0 kg)








TURBINE STARTERS

PERFORMANCE INFORMATION

Pressure psi (bar)	Breakaway Torque ft-lb (Nm)	Speed @ Max HP rpm	Max Power HP (kW)	Flow @ Max HP scfm (L/s)
ST650B				
90 (6.2)	155 (210)	2300	34 (25)	850 (401)
120 (8.3)	225 (305)	2350	50 (37)	1150 (543)
150 (10.3)	260 (352)	2600	65 (49)	1450 (684)
ST699B				
30 (2.1)	110 (149)	1950	20 (15)	600 (283)
60 (4.1)	195 (264)	2200	41 (31)	1150 (543)
90 (6.2)	290 (393)	2400	67 (50)	1700 (802)

Note: Over torque safety clutch set between 330 to 440 ft-lb (447 to 596 Nm)

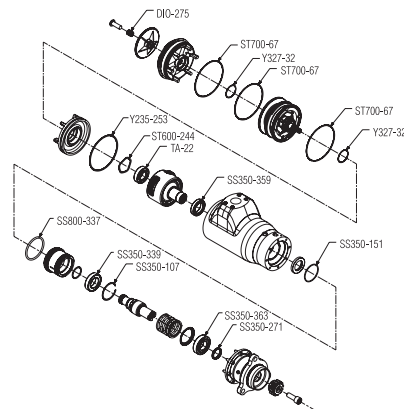
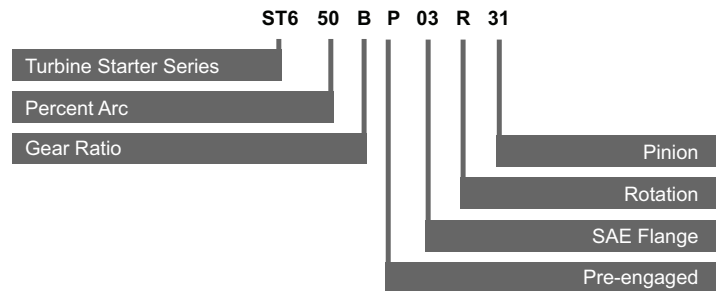
PARTS AND ACCESSORIES

	Part Number	Description
	150BMP-1051B	1/4" 12 V Solenoid Valve
	150BMP-2451B	1/4" 24 V Solenoid Valve
	SMB-618	Push Button Valve
	SRV150	1 1/2" Relay Valve
	150BMP-1058	Gladhand
	ST1000-267-24	1 1/2" Strainer Housing
	ST1000-266-24	1 1/2" Strainer (40 mesh)
	150BMP-1056	1/2" Check Valve

GENUINE INGERSOLL RAND REPLACEMENT KITS

Tune Up Kit Part Number	Description
ST600-TK1	ST600 Starter Tune Up Kit
ST600-SK1	ST600 Starter Seal Kit

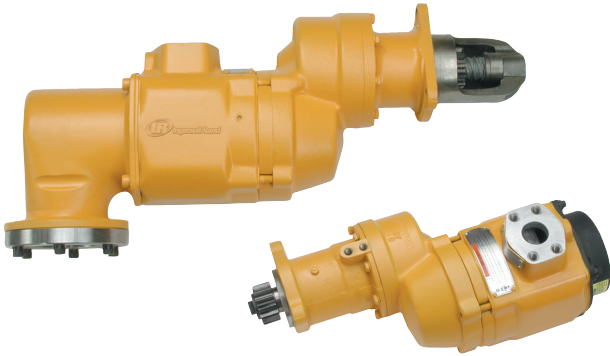
MODEL CODING



Exploded View of ST600-TK1 Part Location

TURBINE STARTERS

ST700/900 SERIES



For engine displacement of:

Diesel—1000 to 20,000 CID (16 to 320 liters)

Carbureted—2000 to 40,000 CID
(32 to 660 liters)

FEATURES/BENEFITS

- Powerful 66 HP turbine motor uses no external lubrication
- Robust gearing handles extended crank cycles
- B and C gearing options provide a broad range of starting torques
- Sealed, oil-lubricated planetary gears provide maintenance free operation

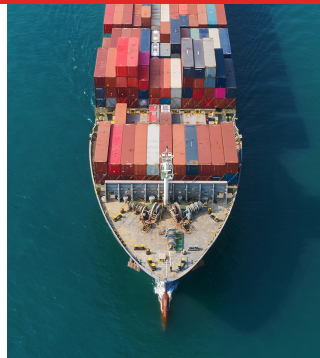
VERSATILE

- Sealed for use in gas and air applications
- Inertia and pre-engaged drives
- Left- or right-hand rotation
- 4 inlet, 4 exhaust, and 16 drive housing orientations
- 30-150 psi (2.1-10.3 bars) operation

INDUSTRY APPLICATIONS



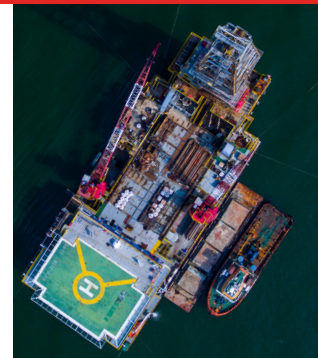
Locomotive



Marine



Off-highway



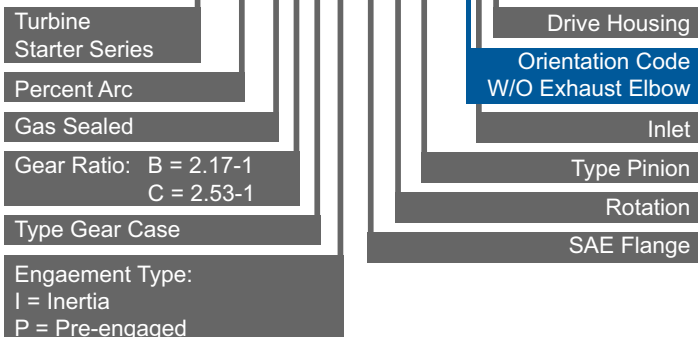
Oil and Gas



Power generation

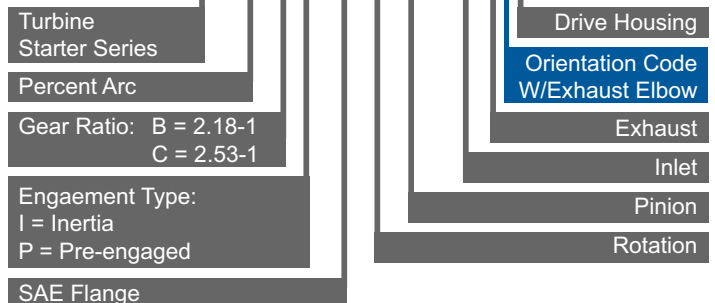
MODEL CODING FOR ST700

ST7 50 GBD P 03R 31 - 2P



MODEL CODING FOR ST900

ST9 50 B P 03 R 31 - 0 2 G



TURBINE STARTERS

DIMENSIONS

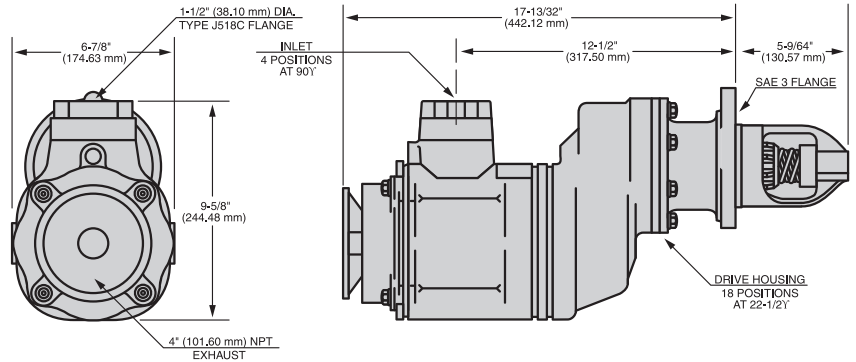
ST750/ST799GBI &
ST950/ST999BI INERTIA

Weight:

ST750/ST799GBI 62 lbs (28.1 kg)

ST950/ST999BI 62 lbs (28.1 kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.



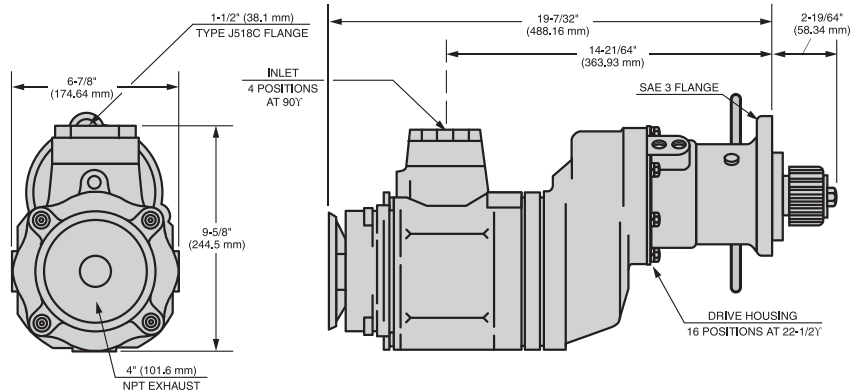
ST750/ST799 & ST950/ST999
B & C

RATIO PRE-ENGAGED

Weight:

ST750/ST799GBPD 63 lbs (28.6 kg)

ST950/ST999BP 63 lbs (28.6 kg)







PERFORMANCE INFORMATION

Pressure psi (bar)	Breakaway Torque ft-lb (Nm)	Speed @ Max HP rpm	Max Power HP (kW)	Flow @ Max HP scfm (L/s)
ST750/ST950 B RATIO (INERTIA & PRE-ENGAGED)				
90 (6.2)	160 (217)	1950	30 (22)	850 (401)
120 (8.3)	225 (305)	2100	45 (34)	1100 (519)
150 (10.3)	250 (339)	2350	55 (41)	1300 (614)
ST799/ST999 B (INERTIA & PRE-ENGAGED)				
30 (2.1)	110 (149)	1750	18 (13)	700 (330)
60 (4.1)	195 (264)	1950	36 (27)	1200 (566)
90 (6.2)	310 (420)	2250	66 (49)	1700 (802)
ST750/ST950 C RATIO (PRE-ENGAGED)				
90 (6.2)	190 (257)	1675	30 (22)	850 (401)
120 (8.3)	260 (352)	1800	45 (34)	1100 (519)
150 (10.3)	285 (386)	2000	55 (41)	1300 (614)
ST799/ST999 C RATIO (PRE-ENGAGED)				
30 (2.1)	130 (175)	1500	18 (13)	700 (330)
60 (4.1)	225 (305)	1630	36 (27)	1200 (566)
90 (6.2)	360 (485)	1935	66 (49)	1700 (802)

TURBINE STARTERS

PARTS AND ACCESSORIES

	Part Number	Description
	150BMP-1051B	1/4" 12 V Solenoid Valve
	150BMP-2451B	1/4" 24 V Solenoid Valve
	SMB-G618	Gas Rated Push Button Valve
	SMB-618	Push Button Valve
	SRV150	1 1/2" Relay Valve for Air
	SRV150SS	1 1/2" Gas Rated Relay Valve

	Part Number	Description
	150BMP-1064	1/8", 150 psi Pressure Gauge
	ST1000-267-24-300	1 1/2" Strainer Housing
	ST1000-267-32-300	2" Strainer Housing
	ST1000-266-24-300	1 1/2" Strainer (300 mesh)
	ST1000-266-32-300	2" Strainer Element (300 mesh)
	150BMP-1056	1/2" Check Valve

GENUINE INGERSOLL RAND REPLACEMENT KITS

Tune Up Kit Part Number	Description
ST700-TK1	ST700 Starter Tune Up Kit
ST700I-TK6	ST700 Inertia Front End Tune Up Kit
ST700P-TK7	ST700 Pre-Engaged Front End Tune Up Kit
ST700D-TK8	ST700 and ST900 D Ratio Kit (4 O-Rings, 1 Retainer Ring)
ST750R-TK2	ST700-TK1 and ST750R-A53 Motor Assembly for RH ST750 Starters

Tune Up Kit Part Number	Description
ST750L-TK3	ST700-TK1 and ST750L-A53 Motor Assembly for LH ST750 Starters
ST799R-TK4	ST700-TK1 and ST799R-A53 Motor Assembly for RH ST799 Starters
ST799L-TK5	ST700-TK1 and ST799L-A53 Motor Assembly for LH ST799 Starters
ST900-GK1	ST900 Gear Kit
ST900-SK1	ST900 Seal Kit

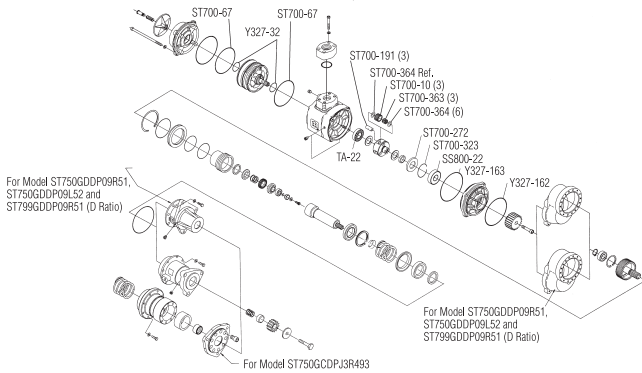


ST700-TK1 Parts

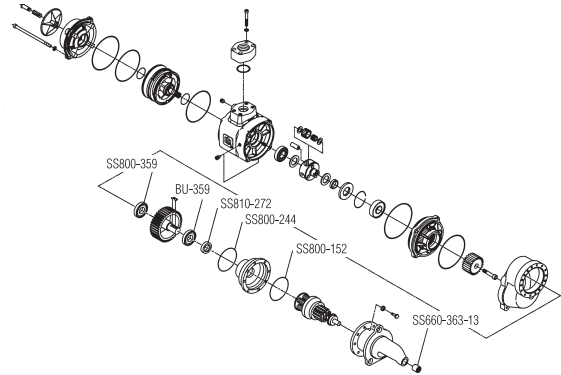


ST700P-TK7 Parts

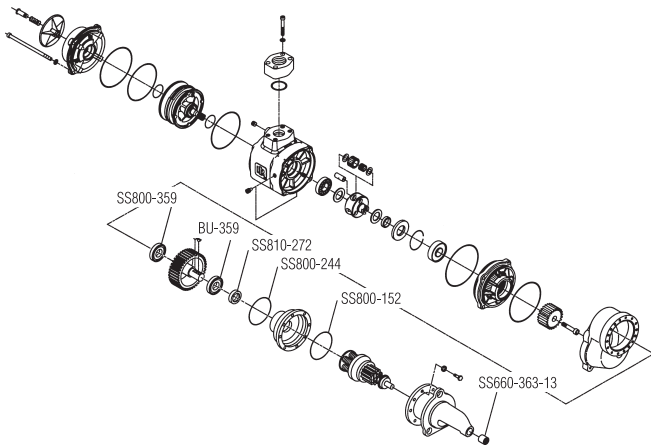
TURBINE STARTERS



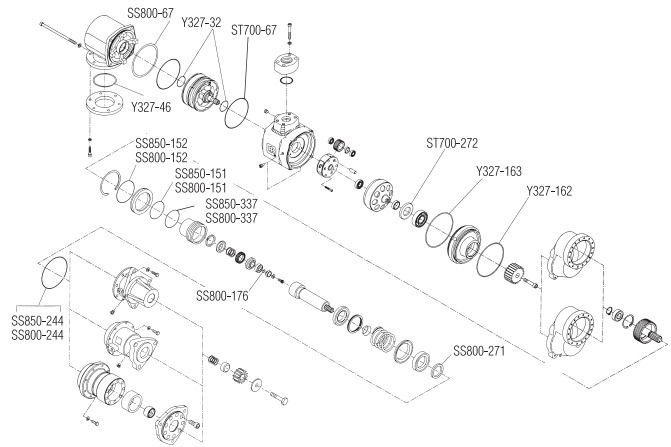
Exploded View of ST700-TK1 Part Location



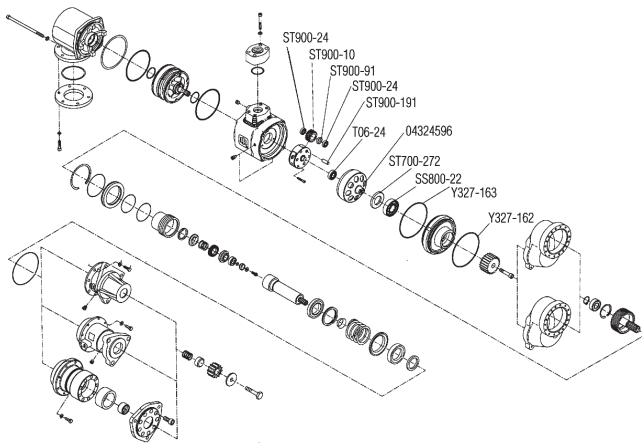
Exploded View of ST700I-TK6 Part Location



Exploded View of ST700P-TK7 Part Location



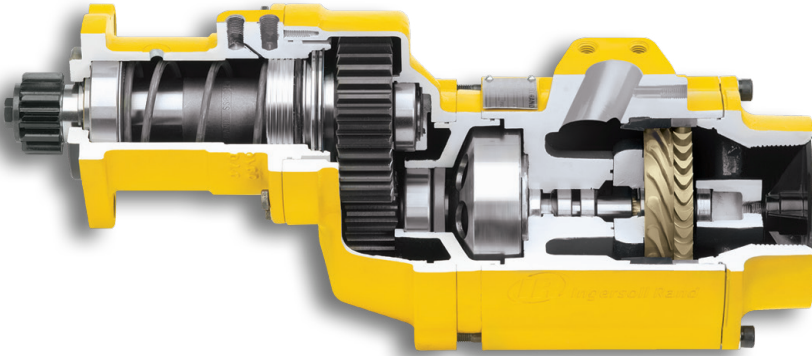
Exploded View of ST900-SK1 Part Location



Exploded View of ST900-GK1 Part Location

TURBINE STARTERS

ST1000/ST1000M SERIES



For engine displacement of:

Diesel—1000 to 20,000
CID (16 to 320 liters)

Carbureted—2000 to
40,000 CID
(32 to 660 liters)

FEATURES/BENEFITS

- Powerful 70 HP turbine motor uses no external lubrication and offers best-in-class efficiency
- Patented, solid aluminum motor design enables reliable operation in harsh, contaminated environments
- Robust gearing handles extended crank cycles
- Patented, fully-supported high-speed rotor extends bearing life by minimizing deflection and ensuring concentric running; a better alternative to cantilever designs

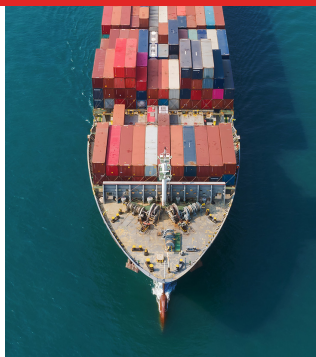
VERSATILE

- Sealed for use in gas and air applications
- Inertia and pre-engaged models
- Left- or right-hand rotation
- 4 inlet, 4 exhaust, and 16 drive housing orientations
- 30-150 psi (2.1-10.3 bars) operation
- Patented slip-fit motor design makes servicing simple and convenient
- ST1000M version with 2-inch NPT inlet reduces the need for piping changes on some competitive models

INDUSTRY APPLICATIONS



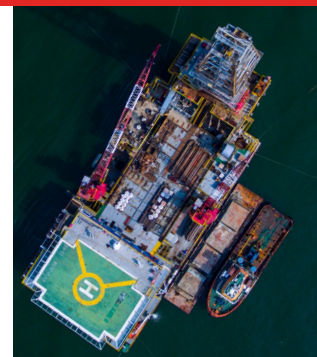
Locomotive



Marine



Off-highway



Oil and Gas



Power generation

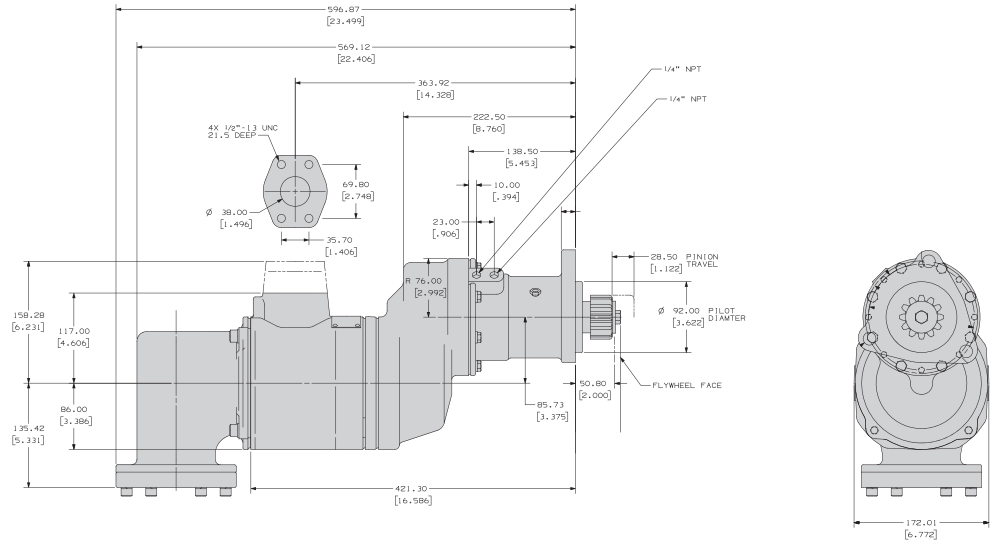
TURBINE STARTERS

DIMENSIONS

PRE-ENGAGED B & C RATIO

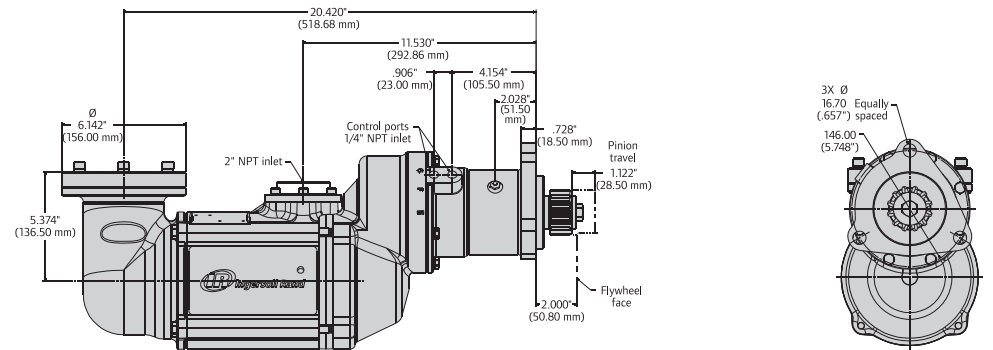
Weight: 76 lbs (34.5 kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.



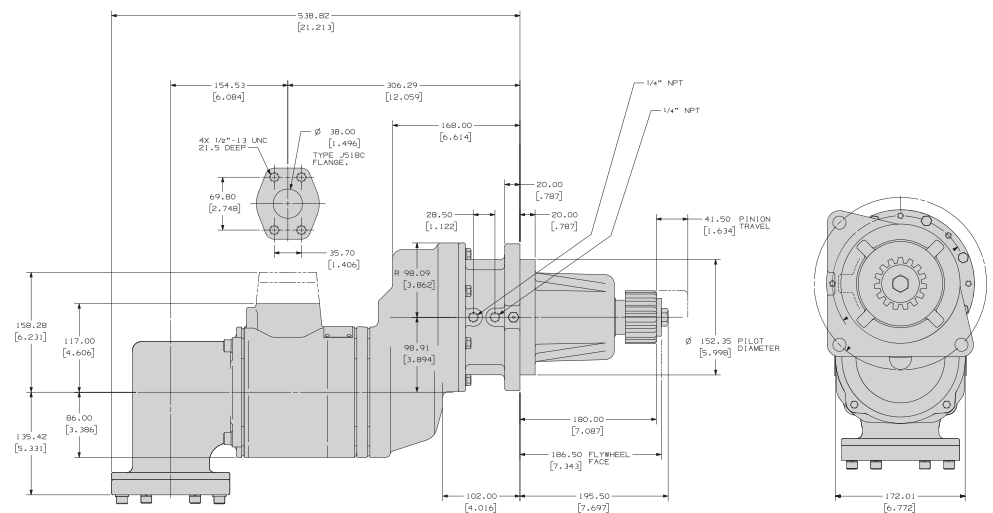
ST1000M

Weight: 76 lbs (34.5 kg)



PRE-ENGAGED D RATIO

Weight: 102 lbs (46.3 kg)



TURBINE STARTERS

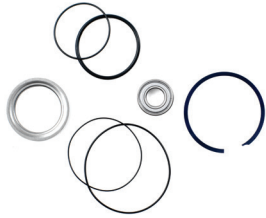
PERFORMANCE INFORMATION

Pressure psi (bar)	Breakaway Torque ft-lb (Nm)	Speed @ Max HP rpm	Max Power HP (kW)	Flow @ Max HP scfm (L/s)
ST1060 B RATIO				
30 (2)	53 (71)	1175	7 (5)	370 (175)
60 (4)	115 (156)	1550	20 (15)	590 (278)
90 (6)	220 (298)	1780	39 (29)	820 (387)
120 (8)	295 (400)	1900	53 (39)	1050 (496)
150 (10)	353 (478)	2050	70 (52)	1290 (609)
ST1099 B RATIO				
30 (2)	82 (111)	1425	13 (10)	540 (255)
60 (4)	200 (271)	1850	36 (27)	890 (420)
90 (6)	347 (470)	2060	68 (51)	1240 (585)
ST1060 C RATIO				
30 (2)	62 (84)	1025	7 (5)	370 (175)
60 (4)	143 (194)	1350	20 (15)	590 (278)
90 (6)	256 (347)	1515	39 (29)	820 (387)
120 (8)	342 (463)	1675	53 (39)	1050 (496)
150 (10)	409 (554)	1780	70 (52)	1290 (609)
ST1099 C RATIO				
30 (2)	98 (133)	1225	13 (10)	540 (255)
60 (4)	234 (317)	1580	36 (27)	890 (420)
90 (6)	400 (542)	1770	68 (51)	1240 (585)
ST1060 D RATIO				
30 (2)	85 (115)	765	7 (5)	370 (175)
60 (4)	195 (264)	985	20 (15)	590 (278)
90 (6)	326 (442)	1125	39 (29)	820 (387)
120 (8)	462 (626)	1205	53 (39)	1050 (496)
150 (10)	557 (755)	1650	70 (52)	1290 (609)
ST1099 D RATIO				
30 (2)	132 (179)	900	13 (10)	540 (255)
60 (4)	318 (431)	1170	36 (27)	890 (420)
90 (6)	540 (732)	1300	68 (51)	1240 (585)

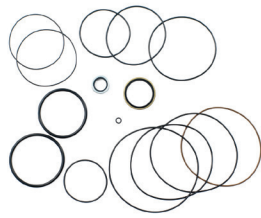
TURBINE STARTERS

GENUINE INGERSOLL RAND REPLACEMENT KITS

Tune Up Kit Part Number	Description
ST700P-TK7	Pre-engaged Tune Up Kit
ST700I-TK6	Inertia Tune Up Kit
ST700D-TK8	D Ratio Tune Up Kit
ST1000-SK1	Seal Kit
ST1000-GK1	Planetary Gear Kit
ST1000R-K53-37	Rotor Replacement Kit (RH)

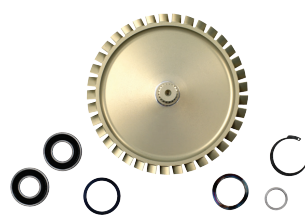


ST700P-TK7 Parts



ST1000-SK1 Parts

Tune Up Kit Part Number	Description
ST1000L-K53-37	Rotor Replacement Kit (LH)
ST1000-K24	Rotor Bearing Kit
ST1000R-K212	Motor Adapter Kit (RH)
ST1000L-K212	Motor Adapter Kit (LH)
ST1000K-562	Straight Exhaust Kit
ST1000K-350	Elbow Exhaust Kit




ST1000R-K53-37
and ST1000L-K53-37 Parts



ST1000K-350 Part

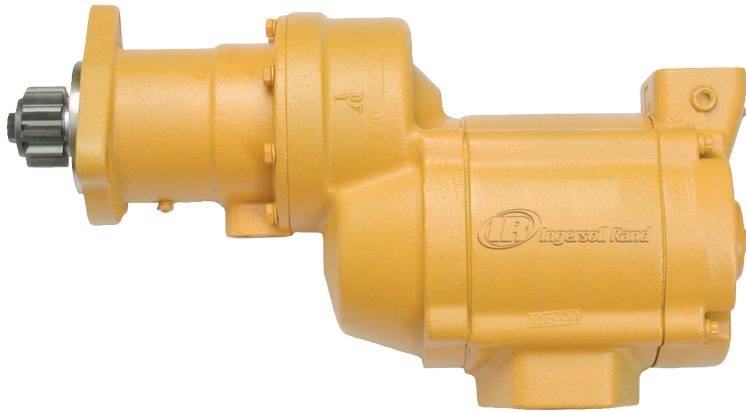
PARTS AND ACCESSORIES

	Part Number	Description
	ST700-K166	Inlet Flange Kit
	ST700-K351	Exhaust Flange Kit
	SRV150	1 1/2" Relay Valve for Air
	SRV150SS	1 1/2" Gas Rated Relay Valve
	ST000-267-24	1 1/2" Strainer Housing
	ST1000-267-32	2" Strainer Housing

	Part Number	Description
	ST1000-266-24	1 1/2" Strainer (40 mesh)
	ST1000-266-32	2" Strainer (40 mesh)
	SMB-618	Push Button Valve
	SMB-G618	Gas Rated Push Button Valve
	38600714 (RR152-F30)	High Pressure Regulator Relay Valve 1 1/2" 90 Degree
	38754917 (RR152-F30-14)	High Pressure Regulator Relay Valve (for use with air only) 1 1/2" In-line

SUPERIOR ENGINEERING, LEGENDARY PERFORMANCE

VANE STARTERS



With their simple, rugged design, easy maintenance, and legendary durability, Ingersoll Rand vane starters reign as the most commonly used air starters in the world. Our vane motors develop maximum horsepower at speeds as low as 5000 RPM plus require only a small amount of lubrication for maximum life. This ability to thrive at lower speeds improves each motor's bearing life, minimizes planetary gear reduction and delivers more torque per pound than other displacement motors.

- High torque, lower RPMs
- Easy field serviceability
- Modular design shares components with turbine starters

Reliability and high-efficiency at a low cost have made our 150 BM and SS800 models the benchmark starters in their class.



VANE STARTERS

VANE STARTERS SELECTION GUIDE

For Diesel Engine Displacement (liters)	Catalog Section	Series	Gear Ratio	Extended Starting Capability (>10 sec.)	Max Power (HP)	Max Pressure psi (bar)	Air Consumption at Max HP scfm (L/s)	Engagement Type**	Inlet Size (NPT)	Exhaust Size (NPT)	Gas Sealed
NO LUBRICATION REQUIRED											
1 to 15	G	SS100*	E	No	15	150 (10.3)	415 (196)	Pre-Engaged or Inertia	1"	1½"	Yes
LUBRICATION REQUIRED											
8 to 27	G	150BMG	E	No	32	150 (10.3)	680 (321)	Inertia	1¼"	1¼"	Yes
8 to 27	G	150BMP	E	No	32	150 (10.3)	680 (321)	Pre-Engaged	1¼"	1¼"	No
15 to 32	G	150BMP	D	No	32	150 (10.3)	680 (321)	Pre-Engaged	1¼"	1¼"	No
8 to 27	F	SS350G	E	No	36	150 (10.3)	900 (425)	Pre-Engaged	1¼"	1½"	Yes
16 to 130	H	SS810	B	No	80	150 (10.3)	1700 (802)	Inertia	1½"	2½"	Yes
16 to 130	H	SS815	B	No	80	150 (10.3)	1700 (802)	Pre-Engaged	1½"	2½"	Yes
80 to 200	H	SS825	C	No	75	150 (10.3)	1350 (637)	Pre-Engaged	1½"	2½"	Yes
160 to 320	H	SS850	D	No	75	150 (10.3)	1275 (602)	Pre-Engaged	1½"	2½"	Yes

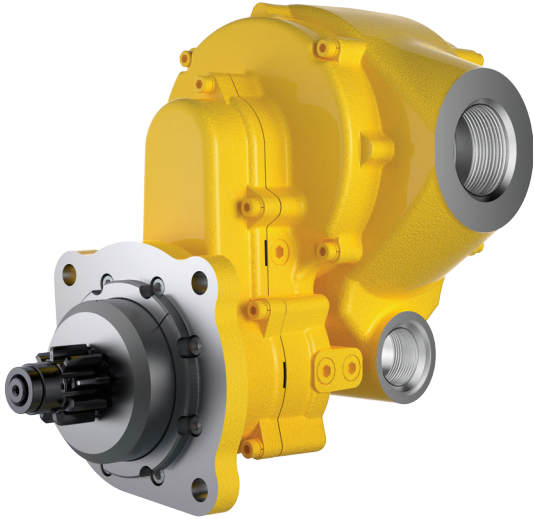
These figures are only a guide. For difficult-to-start engines or for operation under adverse conditions, use the next more powerful starter. For 2-stroke diesel engines, these figures may be multiplied by 1.5. Ex: an SS100 could be used on a 15 liter 2-stroke diesel engine. For carbureted (gas) engines, these figures may be doubled. Ex: a 150BMP could be used on a 54 liter gas engine. Note 1 liter = 61.02 in³.

** There are two basic types of air starters: pre-engaged and inertia. With pre-engaged starters, the drive pinion is completely engaged with the engine ring gear before the starter begins to crank the engine. With an inertia starter, the rotating drive pinion engages the engine ring gear simultaneously with the initial cranking of the engine.

*The SS100 is lube-free

VANE STARTERS

SS100 SERIES



For engine displacement of:

Diesel—0 to 600 CID (0 to 15 liters)

Carbureted—0 to 1200 CID (0 to 20 liters)

FEATURES/BENEFITS

- Powerful, revolutionary lube-free vane motor can be used with air or natural gas
- Alloy steel motor components ensure reliability in harsh conditions
- Offset-gear design for rugged power transfer and easy field service
- Class-leading starting torque for engines up to 15 liters
- One starter replaces the 3BM, 5BM and SS175 series

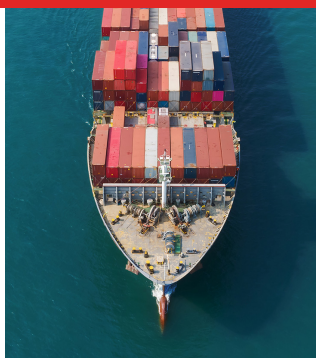
VERSATILE

- One size fits engines up to 15 liters to lower cost and reduce inventory
- Compact design and flexible mounting for easy fit-up
- Standard and metric pinions fit most manufacturers' engines
- Overhung pinion and 360° flange design for easy installation
- Dependable accessories including valves, mufflers and deflectors

INDUSTRY APPLICATIONS



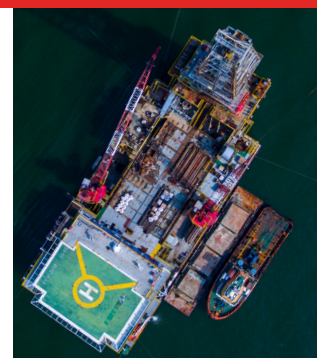
Locomotive



Marine



Off-highway



Oil and Gas



Power generation

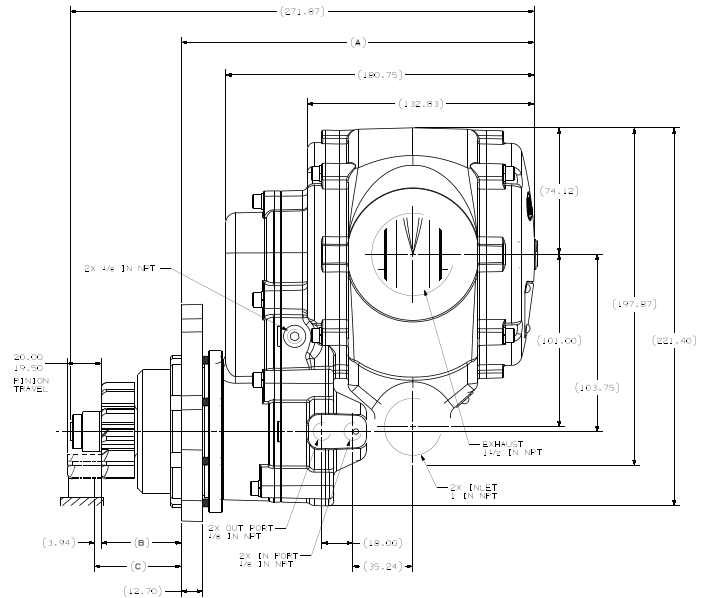
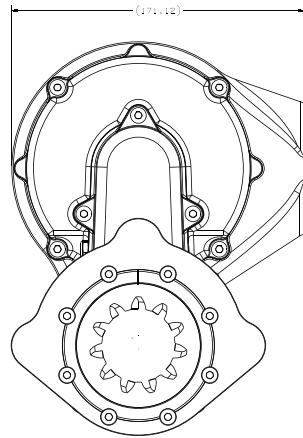
VANE STARTERS

DIMENSIONS

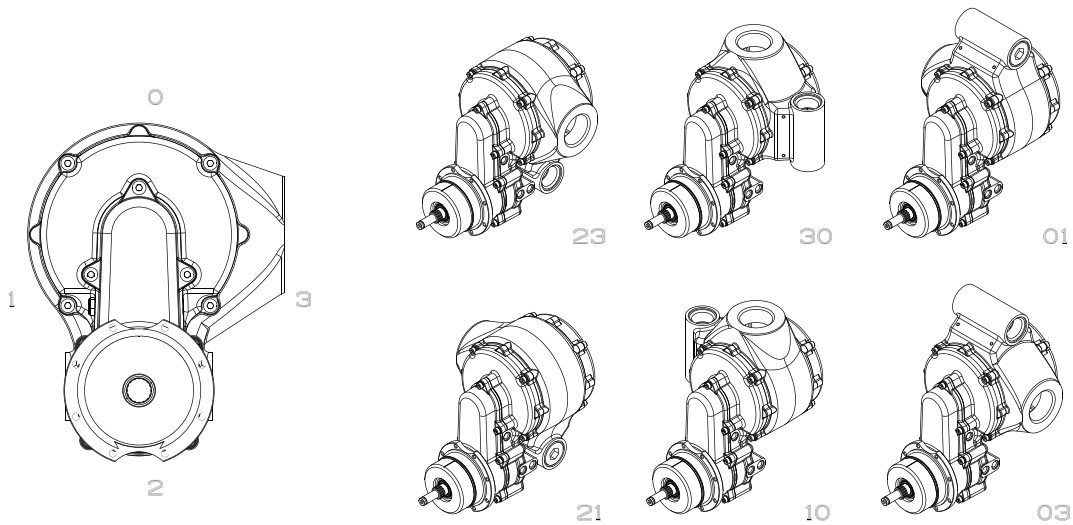
SS100

Weight: 28lbs (12.7 kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.



HOUSING ORIENTATIONS







PERFORMANCE INFORMATION

Pressure psi (bar)	Breakaway Torque ft-lb (Nm)	Speed @ Max HP rpm	Max Power HP (kW)	Flow @ Max HP scfm (L/s)
SS100				
30 (2.1)	16 (22)	1290	2.3 (1.7)	110 (52)
60 (4.1)	39 (53)	1625	6.4 (4.8)	215 (101)
90 (6.2)	55 (75)	1800	9.6 (7.2)	315 (149)
120 (8.3)	75 (102)	1900	13.8 (10.3)	415 (196)
150 (10.3)	75 (102)	1900	13.8 (10.3)	415 (196)

VANE STARTERS

PARTS AND ACCESSORIES

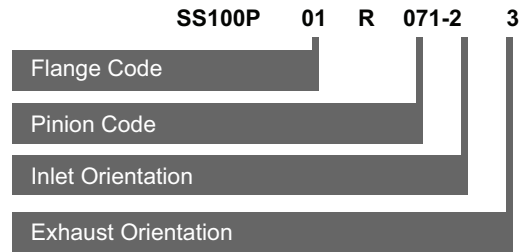
	Part Number	Description
	SRV100	1" Relay Valve
	SRV100-SMB	1" Relay Valve with Push Button
	SRV150SS	1 1/2" Gas Rated Relay Valve
	SS350-A674	1 1/2" Muffler
	SS350-A735	Exhaust Deflector
	150BMP-1051B	1/4" 12 V Solenoid Valve
	150BMP-2451B	1/4" 24 V Solenoid Valve

	Part Number	Description
	SMB-618	Push Button Valve
	SMB-G618	Push Button Valve for Natural Gas
	ST1000-267-16	1" Strainer Housing
	ST1000-267-24	1 1/2" Strainer Housing
	ST1000-266-16	1" Strainer (40 mesh)
	ST1000-266-24	1 1/2" Strainer (40 mesh)

GENUINE INGERSOLL RAND REPLACEMENT KITS

Tune Up Kit Part Number	Description
SS100-TK1	Tune Up Kit
SS100-GK1	Gear Kit
SS100-TK2	Drive Housing Seal Kit
SS100-K299	Drive Kit
SS100-K299-18	Pinion Hardware Kit
SS100-K301-01	Flange Kit, SAE 01
SS100-K301-03	Flange Kit, SAE 03
SS100-K301-04	Flange Kit, SAE 04
SS100-K301-GM	Flange Kit, GM

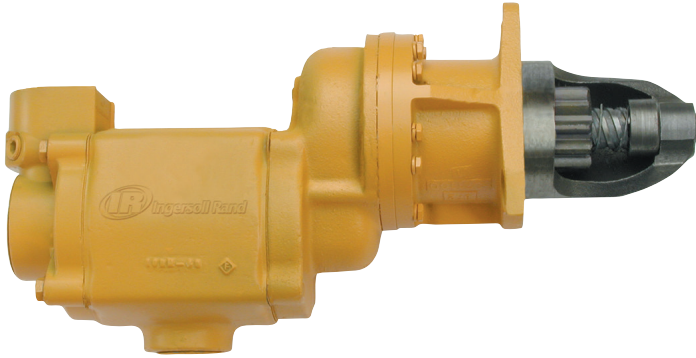
MODEL CODING



SS100-TK1 Parts SS100-GK1 Parts SS100-K301-04 Parts SS100-K301-01 Parts SS100-K301-03 Parts SS100-K301-GM Parts

VANE STARTERS

150BM SERIES



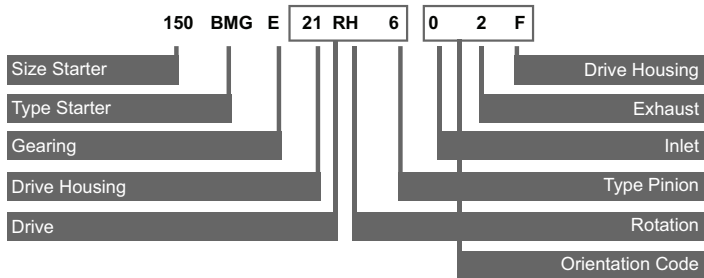
FEATURES/BENEFITS

- Powerful 32 HP motor
- The leading mid-range starter design, the standard by which all others are measured
- Simple design ensures rugged dependability and ease of maintenance
- Multiple offset gear ratios: E = 3.46:1; D = 3.94:1
- Backcap ports for injection lubricating

VERSATILE

- 150BMG sealed for use in air or gas applications
- Offset design for simple mounting
- Inertia and pre-engaged starters available
- Left- and right-hand rotation available
- 4 inlet, 4 exhaust, and 18 drive housing orientations
- 90-150 psi (6.2-10.3 bars) operation

MODEL CODING



For engine displacement of:

Diesel—500 to 2000 CID (8 to 32 liters)

Carbureted—1000 to 4000 CID
(16 to 64 liters)

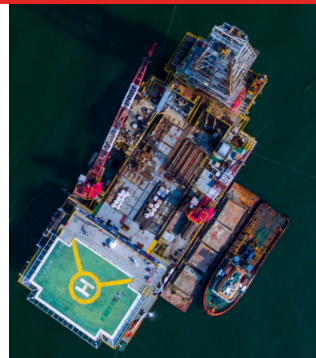
INDUSTRY APPLICATIONS



Marine



Off-highway



Oil and Gas



Power generation



Mining

VANE STARTERS

DIMENSIONS

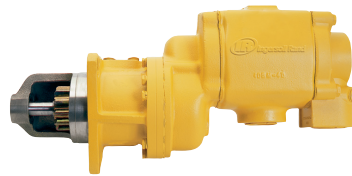
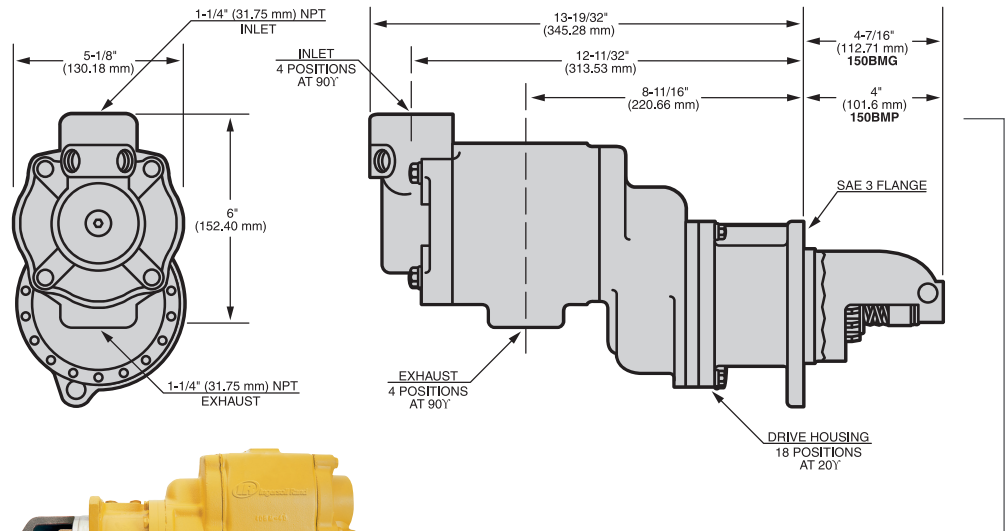
150BMG/150BMP

Weight:

150BMG 38 lbs (17.2 kg)

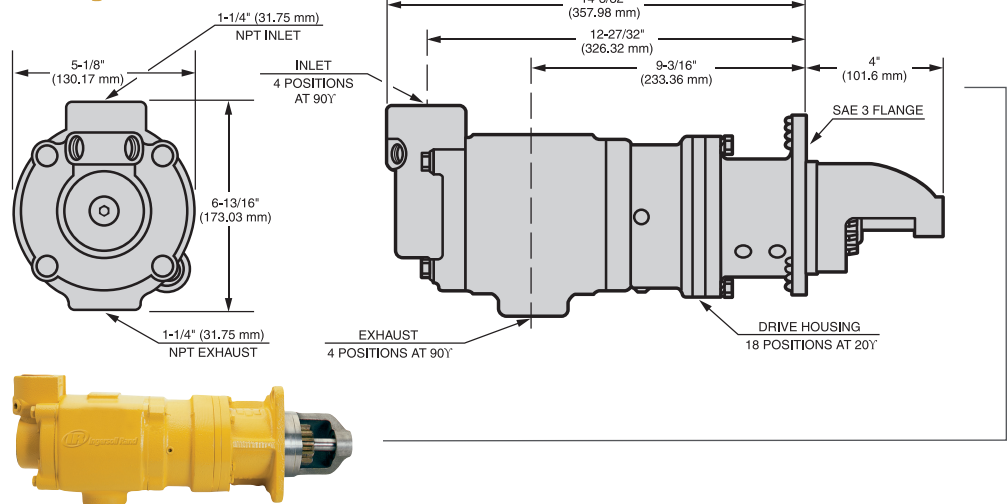
150BMP 40 lbs (18.1kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.



150BMPD

Weight: 40 lbs (18.1 kg)



PERFORMANCE INFORMATION

Pressure psi (bar)	Breakaway Torque ft-lb (Nm)	Speed @ Max HP rpm	Max Power HP (kW)	Flow @ Max HP scfm (L/s)
150BMGE/150BMPE				
90 (6.2)	100 (136)	1700	16 (12)	380 (179)
120 (8.3)	130 (176)	1900	24 (18)	500 (236)
150 (10.3)	155 (210)	2200	32 (24)	680 (321)
150BMPD				
90 (6.2)	110 (149)	1500	16 (12)	370 (175)
120 (8.3)	145 (196)	1700	24 (18)	500 (236)
150 (10.3)	175 (237)	1900	32 (24)	650 (307)

VANE STARTERS

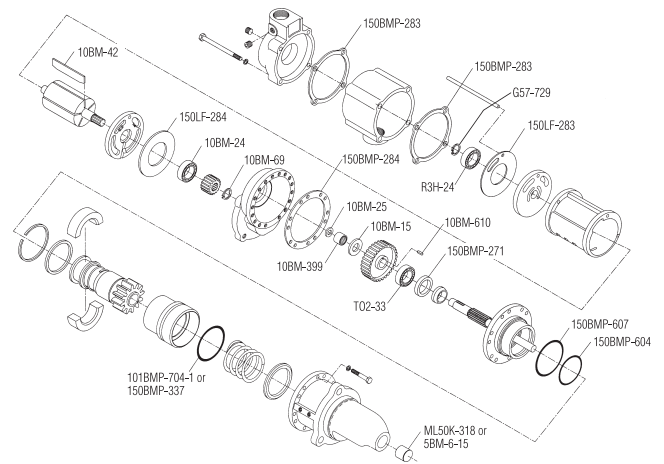
PARTS AND ACCESSORIES

	Part Number	Description
	150BM-A674	1/4" Muffler
	150BMP-1051B	1/4" 12 V Solenoid Valve
	150BMP-2451B	1/4" 24 V Solenoid Valve
	NL-24-8	In-Line Lubricator
	HDL2 (Stationary)	3/8" NPT Lubricator (1.3 cc)
	HDL3 (Transportation)	3/8" NPT Lubricator (0.4 cc)
	SMB-G618	Gas Rated Push Button Valve
	SMB-618	Push Button Valve
	SRV150SS	1 1/2" Gas Rated Relay Valve

	Part Number	Description
	SRV125T	1 1/4" Relay Valve for Vehicular Applications
	SRV125	1 1/4" Relay Valve for Stationary Applications
	ST1000-267-24	1 1/2" Strainer Housing
	ST1000-266-24	1 1/2" Strainer (40 mesh)
	150BMP-1064	1/8", 150 psi Pressure Gauge
	150BM-A735	Road Splash Deflector

GENUINE INGERSOLL RAND REPLACEMENT KITS

Tune Up Kit Part Number	Description
150BM-TK2	150BM Products
150LF-TK2	150LF Products (uses 150LF-42 vanes)
150LF-TK1	150 Motor Gasket Kit for all vane motor 150 products
150BMPD-TK1	150BMPD Products



Exploded View of 150BM-TK2 Part Location

PARTS



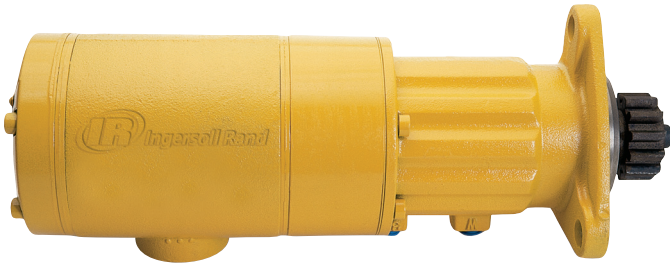
150LF-TK1 Parts



150BM-TK2 Parts

VANE STARTERS

SS350 SERIES



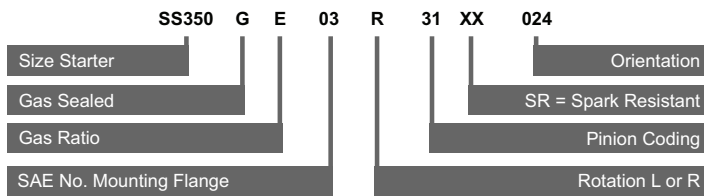
FEATURES/BENEFITS

- Rugged 36 HP motor on SS350
- Overhung pre-engaged pinion design for fit-up flexibility
- Backcap ports for injection lubricating

VERSATILE

- Sealed for use in air or gas applications
- Compact, lightweight design makes installation easier
- Left- or right-hand rotation available
- 4 inlet, 4 exhaust, and 12 housing orientations
- 30-150 psi (2.1-10.3 bars) operation
- SAE 01 and SAE03 mounting flanges fit most worldwide manufacturers' engines

MODEL CODING



For engine displacement of:

Diesel—200 to 1200 CID (3 to 20 liters)

Carbureted—400 to 2400 CID
(6 to 40 liters)

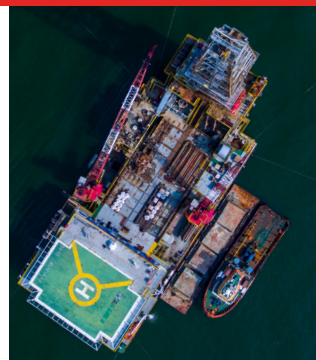
INDUSTRY APPLICATIONS



Marine



Off-highway



Oil and Gas



Power generation



Mining

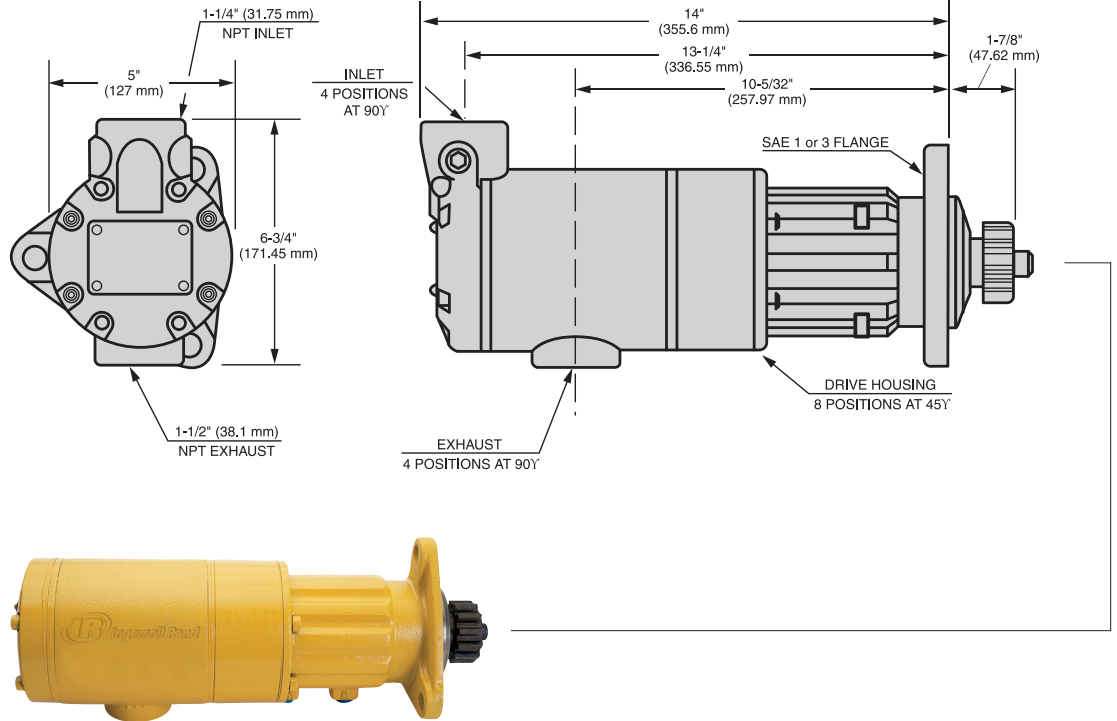
VANE STARTERS

DIMENSIONS

SS350G

Weight: 33 lbs (15.0 kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.











PERFORMANCE INFORMATION

Pressure psi (bar)	Breakaway Torque ft-lb (Nm)		Speed @ Max HP rpm		Max Power HP (kW)	Flow @ Max HP scfm (L/s)
	B RATIO	E RATIO	B RATIO	E RATIO		
SS350						
90 (6.2)	70 (95)	100 (136)	2900	2000	19 (14)	525 (248)
120 (8.3)	90 (122)	130 (176)	3100	2200	27 (20)	750 (354)
150 (10.3)	110 (149)	160 (217)	3400	2400	36 (27)	900 (425)

VANE STARTERS

PARTS AND ACCESSORIES

	Part Number	Description
	SS350-A674	1 1/2" Muffler
	150BMP-1051B	1/4" 12 V Solenoid Valve
	150BMP-2451B	1/4" 24 V Solenoid Valve
	NL-24-8	In-Line Lubricator
	HDL2 (Stationary)	3/8" NPT Lubricator (1.3 cc)
	HDL3 (Transportation)	3/8" NPT Lubricator (0.4 cc)
	SMB-G618	Gas Rated Push Button Valve
	SMB-618	Push Button Valve

	Part Number	Description
	SRV150SS	1 1/2" Gas Rated Relay Valve
	SRV125T	1 1/4" Relay Valve for Vehicular Applications
	SRV125	1 1/4" Relay Valve for Stationary Applications
	150BMP-1064	1/8", 150 psi Pressure Gauge
	ST1000-267-24	1 1/2" Strainer Housing
	ST1000-266-24	1 1/2" Strainer (40 mesh)
	150BMP-1056	1/2" Check Valve

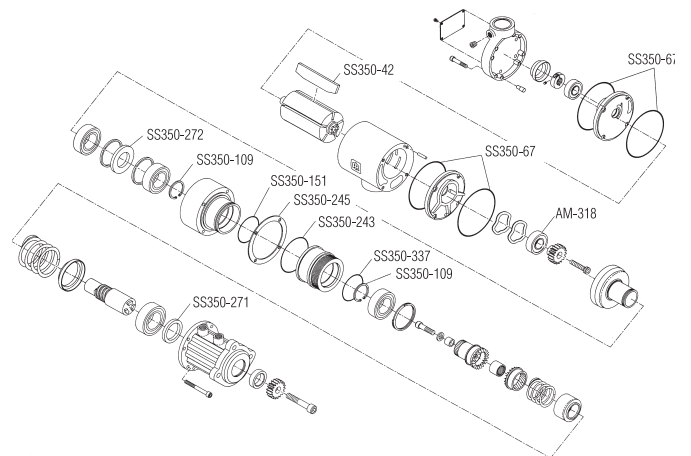
GENUINE INGERSOLL RAND REPLACEMENT KITS

Tune Up Kit Part Number	Description
SS350-TK2	SS350 Tune Up Kit

PARTS



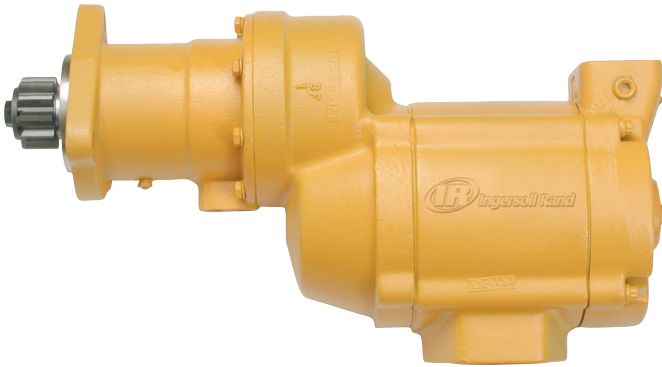
SS350-TK2 Parts



Exploded View of SS350-TK2 Part Location

VANE STARTERS

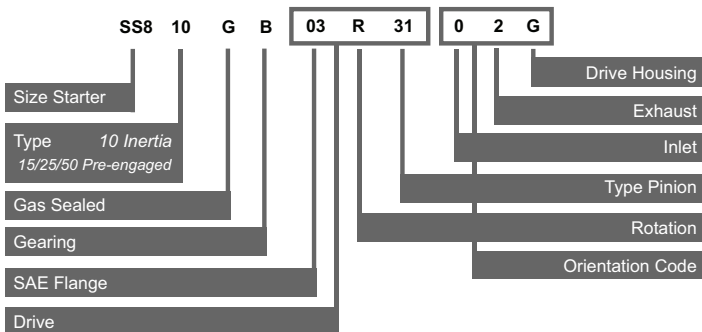
SS800 SERIES



FEATURES/BENEFITS

- Powerful 75 HP motor
- The leading large-frame starter design, the standard by which all others are measured
- Simple design ensures rugged dependability and ease of maintenance
- Multiple offset gear ratios: B = 2.18:1; C = 2.53:1; D = 3.44:1
- Backcap ports for injection lubricating

MODEL CODING



VERSATILE

- All models sealed for use in air or gas applications
- Offset design for simple mounting
- Inertia (SS810) and pre-engaged (SS815, SS825 and SS850) starters available
- 4 inlet, 4 exhaust, and 16 drive housing orientations
- Left- and right-hand rotation available
- 90-150 psi (6.2-10.3 bars) operation



For engine displacement of:

Diesel—1000 to 20,000 CID
(16 to 320 liters)

Carbureted—2000 to 40,000 CID
(32 to 640 liters)

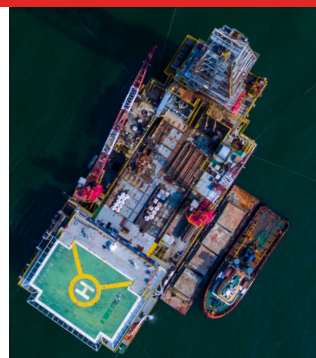
INDUSTRY APPLICATIONS



Marine



Off-highway



Oil and Gas



Power generation



Mining

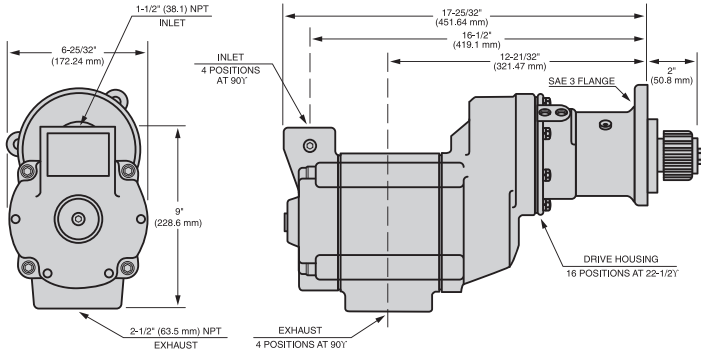
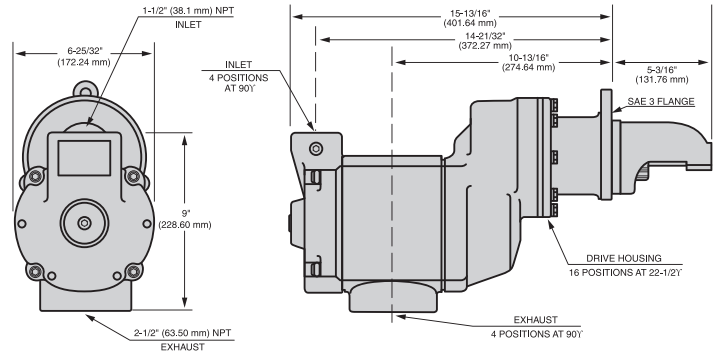
VANE STARTERS

DIMENSIONS

SS810G

Weight: 93 lbs (42.2 kg)

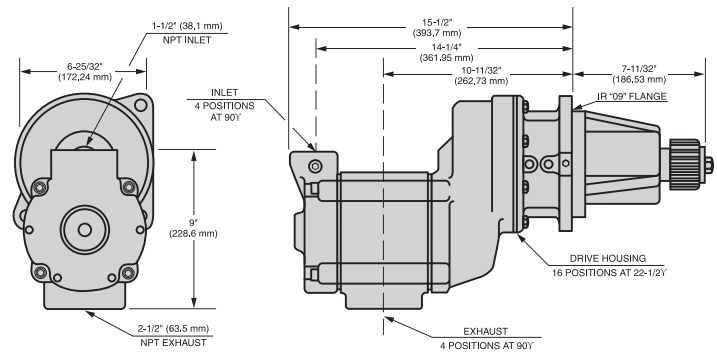
Note: All dimensions shown are for reference only. Specifications subject to change without notice.



SS815G AND SS825G

Weight: SS815G 93 lbs (31.3 kg)

SS825G 95 lbs (43.1 kg)



SS850G

Weight: 123 lbs (55.8 kg)

PERFORMANCE INFORMATION

Pressure psi (bar)	Breakaway Torque ft-lb (Nm)	Speed @ Max HP rpm	Max Power HP (kW)	Flow @ Max HP scfm (L/s)
SS810 AND SS815				
90 (6.2)	170 (230)	2700	45 (34)	1100 (519)
120 (8.3)	205 (278)	2800	58 (43)	1250 (590)
150 (10.3)	250 (339)	3200	75 (56)	1700 (802)
SS825				
90 (6.2)	200 (271)	2300	45 (34)	900 (425)
120 (8.3)	240 (325)	2400	58 (43)	1100 (519)
150 (10.3)	300 (407)	2700	75 (56)	1700 (802)
SS850				
90 (6.2)	260 (352)	1600	45 (34)	800 (378)
120 (8.3)	340 (461)	1800	58 (43)	1000 (472)
150 (10.3)	415 (562)	1900	75 (56)	1275 (602)

VANE STARTERS

PARTS AND ACCESSORIES

	Part Number	Description
	SS800-A674	2 1/2" Muffler
	150BMP-1051B	1/4" 12 V Solenoid Valve
	150BMP-2451B	1/4" 24 V Solenoid Valve
	NL-24-8	In-Line Lubricator
	HDL2 (Stationary)	3/8" NPT Lubricator (1.3 cc)
	HDL3 (Transportation)	3/8" NPT Lubricator (0.4 cc)
	SMB-G618	Gas Rated Push Button Valve
	SMB-618	Push Button Valve

	Part Number	Description
	SRV150	1/2" Relay Valve for Air Applications
	SRV150SS	1/2" Relay Valve for Air Applications
	150BMP-1064	1/8", 150 psi Pressure Gauge
	ST1000-267-24	1 1/2" Strainer Housing
	ST1000-267-32	2" Strainer Housing
	ST1000-266-24	1 1/2" Strainer (40 mesh)
	ST1000-266-32	2" Strainer (40 mesh)

GENUINE INGERSOLL RAND REPLACEMENT KITS

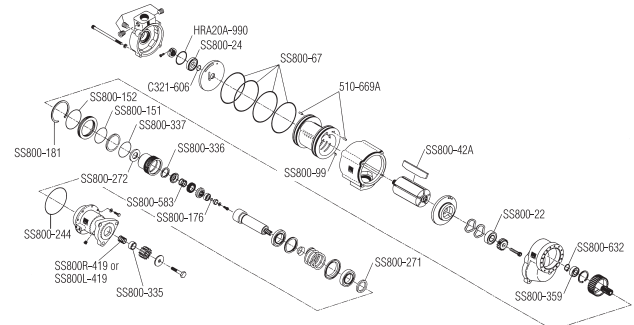
Tune Up Kit Part Number	Description
SS800-TK2	SS815 and SS825 Tune Up Kit
SS810-TK2	SS810 Tune Up Kit
SS850-TK2	SS850 Tune Up Kit



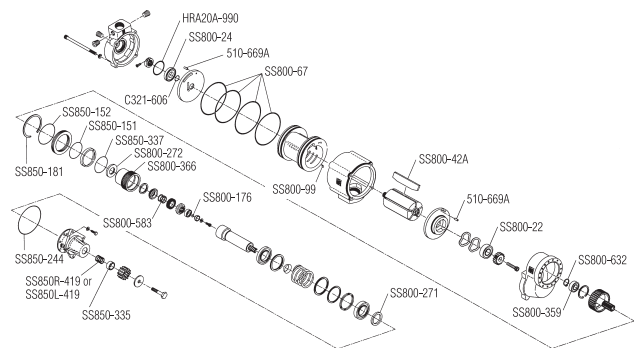
SS800-TK2 Parts



SS810-TK2 Parts



Exploded View of SS800-TK2 Part Location



Exploded View of SS810-TK2 Part Location

TURBINE STARTERS

TS700/TS900/TS1400 SERIES



STARTERS FOR GAS TURBINE ENGINES

FEATURES/BENEFITS

- Powerful turbine motors up to 146 HP require no external lubrication
- sealed oil-bath system internally lubricates the planetary gears and motor bearings
- Air cooling extends bearing and seal life
- No internal or external shut-off devices

VERSATILE

- Multiple spline pinions
- Multiple gear ratios for matching the optimum engine characteristics
- Multiple flange options
- Gas-sealed for application flexibility

INDUSTRY APPLICATIONS



Marine



Power generation

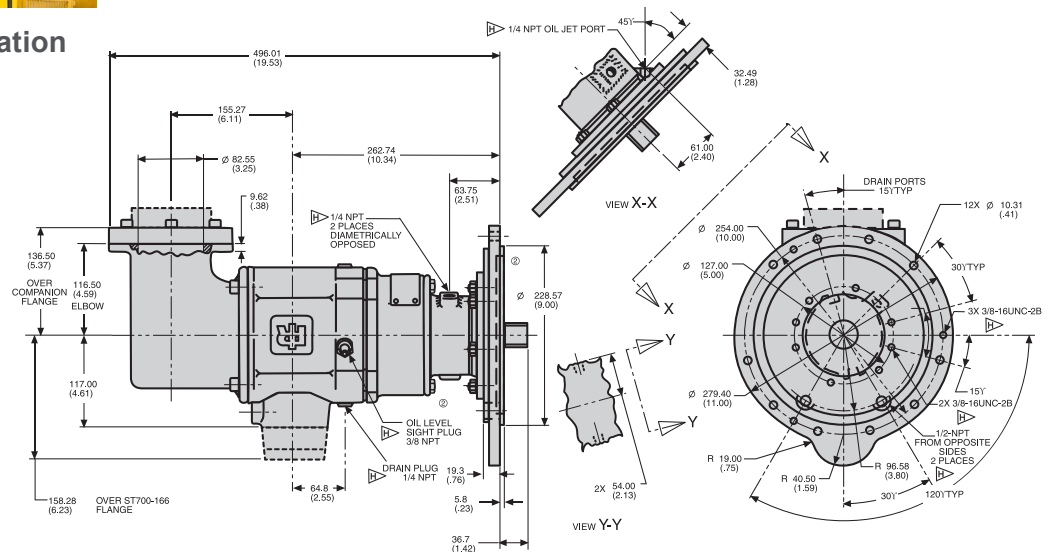
DIMENSIONS

TS725/TS750GBBE-LE

Weight: TS725GBBE-LE 80 lbs (36.3 kg)

TS750GBBE-LE 80 lbs (36.3 kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.



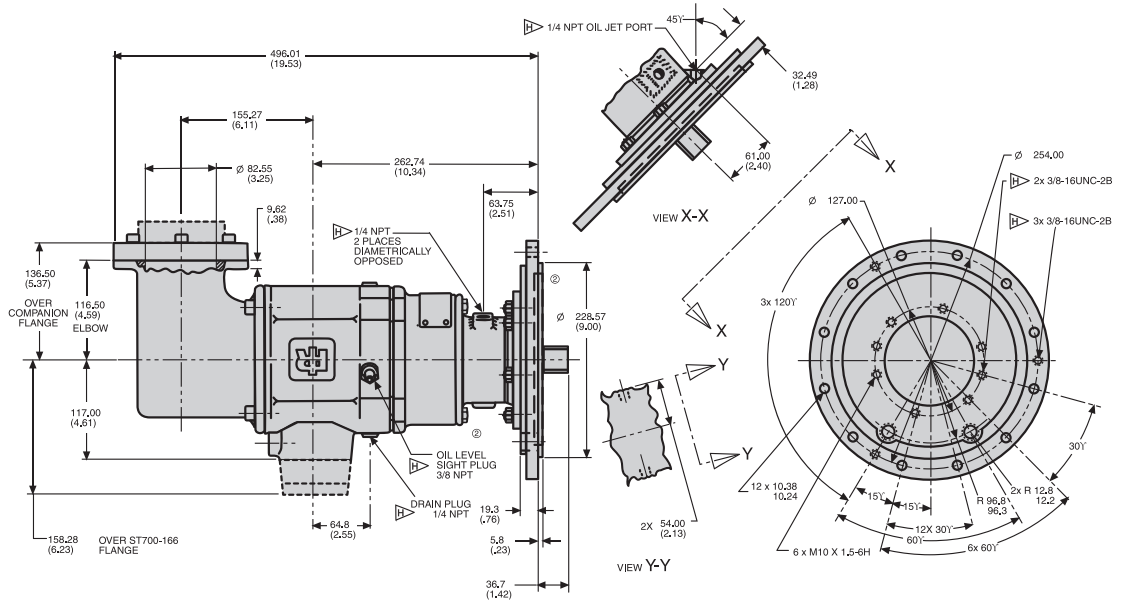
TURBINE STARTERS

DIMENSIONS

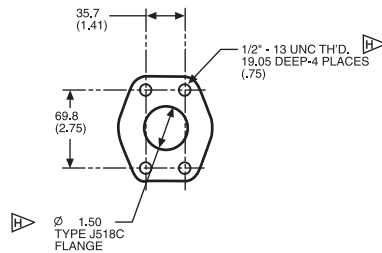
TS725GBDE-LE

Weight: 80 lbs (36.3 kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.

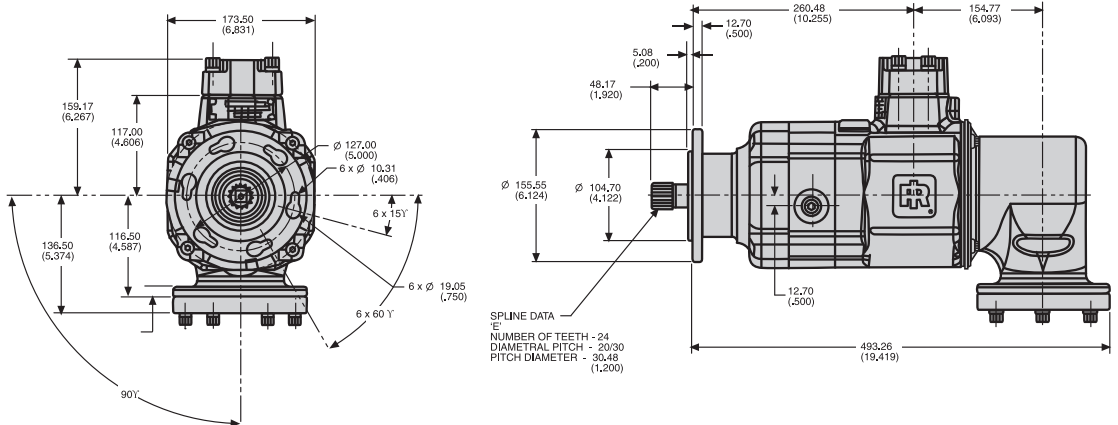


INLET FLANGE KIT (ST700-K166)



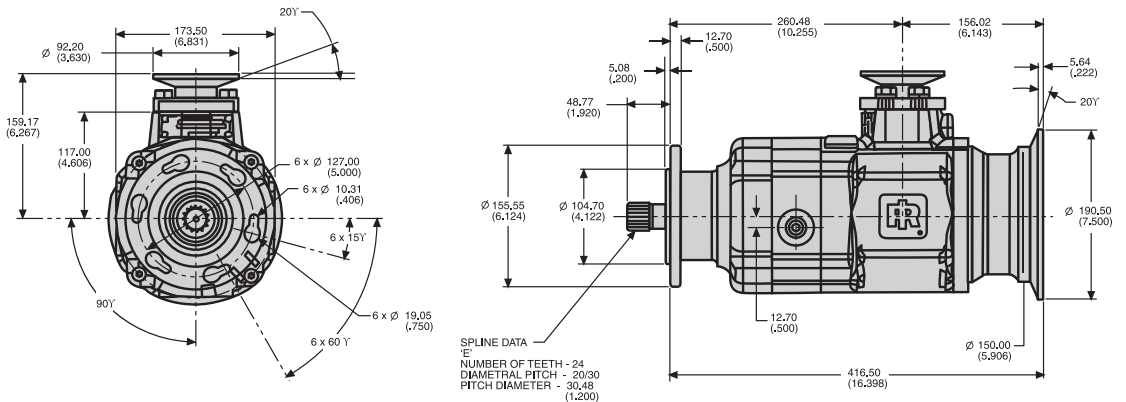
TS799BBEF-LE

Weight: 70 lbs (31.8 kg)



TS799BBEF-LM

Weight: 62 lbs (28.1 kg)



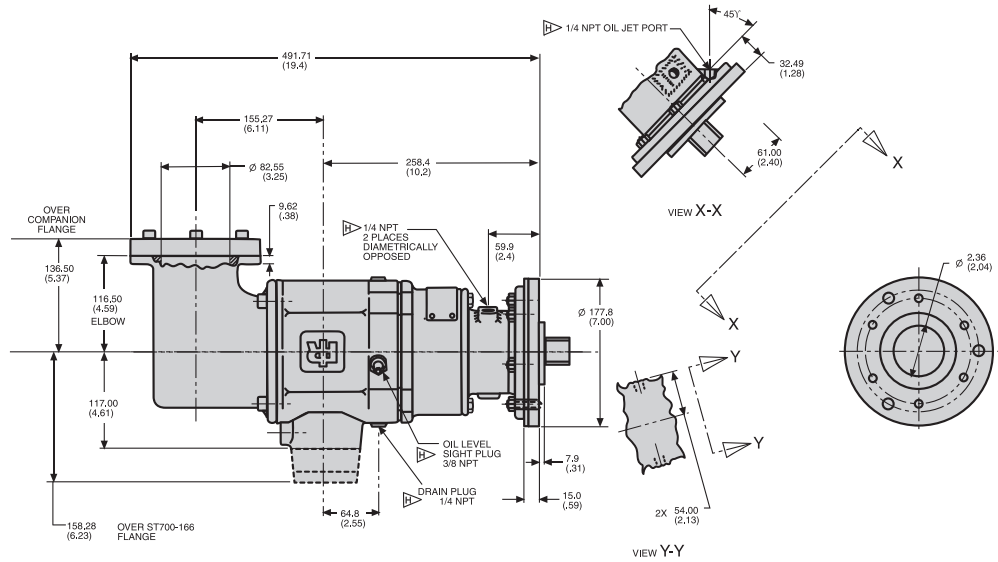
TURBINE STARTERS

DIMENSIONS

TS799GBFD-L

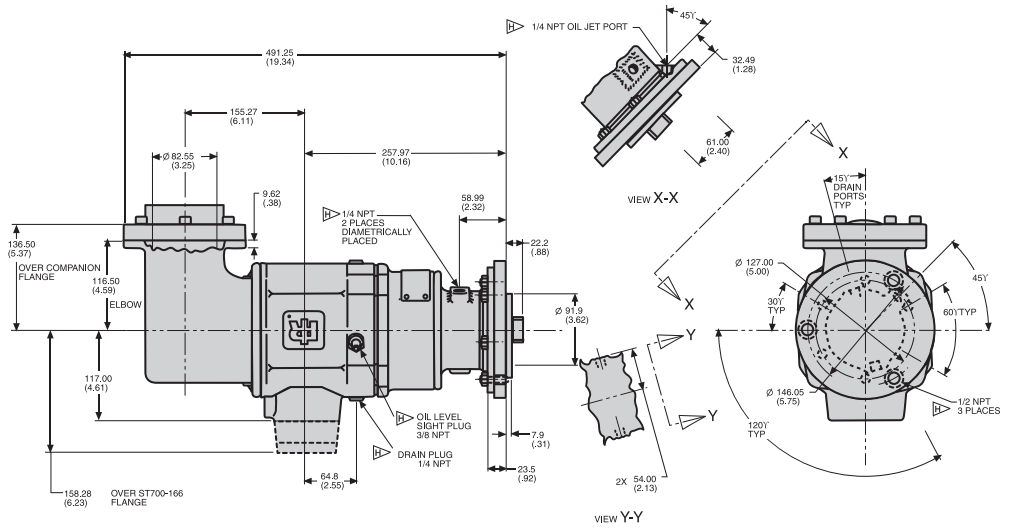
Weight: 70 lbs (31.8 kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.



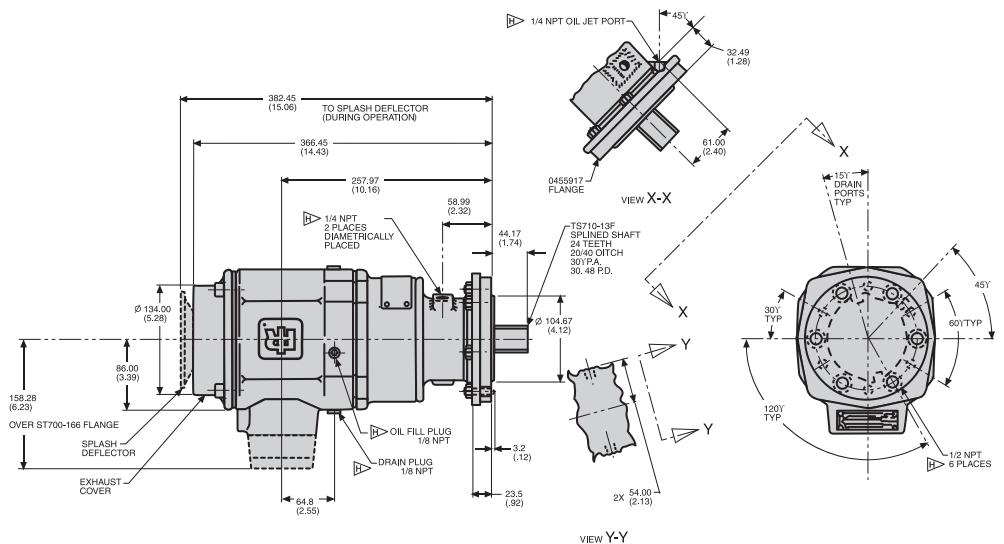
TS999GZCD-LE

Weight: 70 lbs (31.8 kg)



TS999GZFA-L

Weight: 58 lbs (26.3 kg)



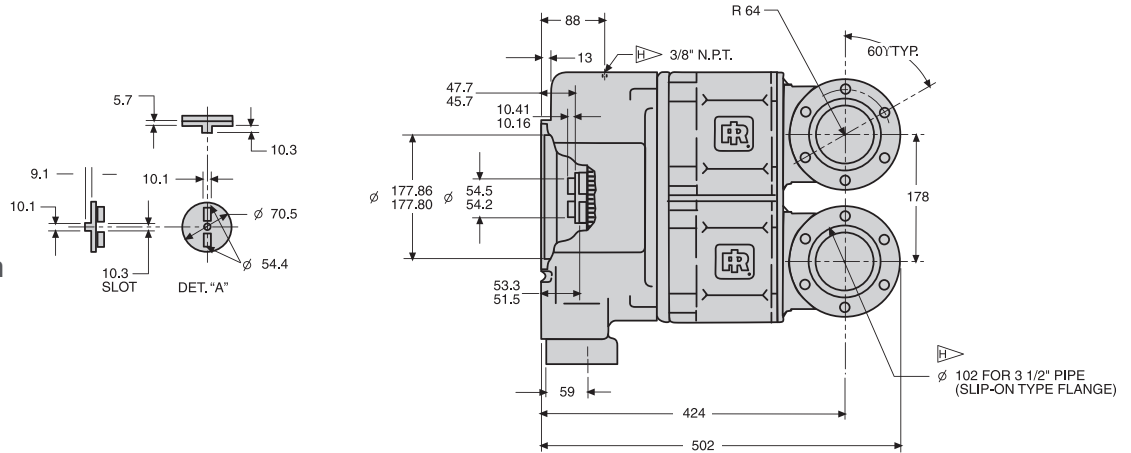
TURBINE STARTERS

DIMENSIONS

TS1400 TURBINE UNITS

Weight: 124 lbs. (56.2 kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.



SINGLE MOTOR PERFORMANCE INFORMATION

Pressure psi (bar)	Breakaway Torque ft-lb (Nm)	Speed @ Max HP rpm	Max Power HP (kW)	Flow @ Max HP scfm (L/s)
TS725				
90 (6.2)	110 (149)	2000	18 (13)	330 (156)
150 (10.3)	180 (243)	2300	40 (30)	515 (243)
225 (15.5)	270 (365)	2500	65 (49)	750 (354)
TS750				
90 (6.2)	170 (230)	2200	30 (22)	850 (401)
120 (8.3)	240 (325)	2300	50 (37)	990 (467)
150 (10.3)	300 (407)	2500	70 (52)	1210 (571)
TS799G				
60 (4.1)	250 (339)	2400	55 (41)	1050 (496)
90 (6.2)	310 (420)	2500	70 (52)	1400 (661)
TS799B				
150 (10.3)	570 (773)	2500	130 (97)	2200 (1038)
TS999				
90 (6.2)	125 (169)	5500	71 (53)	1300 (614)

DUAL MOTOR PERFORMANCE INFORMATION

Pressure psi (bar)	Solar Part Number	Max Pressure psi (bar)	Breakaway Torque ft-lb (Nm)	Speed @ Max HP rpm	Max Power HP (kW)	Flow @ Max HP scfm (L/s)	Motor Arc
TS1400							
TS1401-102	190475-102	225 (15.5)	420 (567)	3100	124 (93)	1700 (802)	25%
TS1435	190475-301	225 (15.5)	459 (620)	3882	141 (105)	1900 (896)	35%
TS1450	190475-401	150 (10.3)	506 (683)	3034	146 (109)	2500 (1179)	50%

TURBINE STARTERS

TS ENGINE SELECTION GUIDE

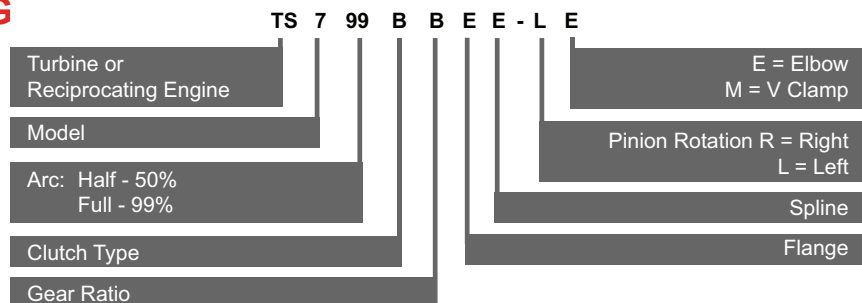
Engine	Part Number	Solar Part Number	Max Pressure psi (bar)
Solar Saturn	TS725GBBE-LE	190716-200	225 (15.5)
	TS725GBDE-LE	190716-100	225 (15.5)
	TS750GBBE-LE	-	150 (10.3)
Solar Centaur	TS1435	190475-301	225 (15.5)
	TS1450	190475-401	180 (12.2)
	TS1401-102	190475-102	225 (15.5)
Solar Taurus	TS1435	190475-301	225 (15.5)
	TS1450	190475-401	180 (12.2)
	TS1401-102	190475-102	225 (15.5)
Allison 570	TS799GBFD-L	-	90 (6.2)
Allison 501-KC	TS999GZFA-L	-	90 (6.2)
Allison 501-KB	TS999GZFA-L	-	90 (6.2)
Garret IE831	TS999GZCD-LE	-	90 (6.2)
Pratt & Whitney GG3/F13, GG4/G14	TS799BBEF-LE	-	150 (10.3)
	TS799BBEF-LM	-	150 (10.3)

This chart is a condensed list of engines that can be cranked with a starter. For a complete list, please contact Ingersoll Rand at NashCOE@irco.com.

TS700/TS900 OUTPUT SPLINE DATA


TS Part Number	Shaft Output Part Number	Teeth	Diametral Pitch	Pressure Angle	Pitch Diameter
TS725GBBE-LE	TS710-13E	24	20/30	30	30.48
TS725GBDE-LE	TS710-13E	24	20/30	30	30.48
TS750GBBE-LE	TS710-13E	24	20/30	30	30.48
TS799BBEF-LE	TS799-18E	24	20/30	30	30.48
TS799BBEF-LM	TS799-18E	24	20/30	30	30.48
TS799GBFD-L	4612834	16	20/30	30	20.32
TS999GZCD-LE	4612834	16	20/30	30	20.32
TS999GZFA-L	TS710A-13F	24	20/40	30	30.48

MODEL CODING



TURBINE STARTERS

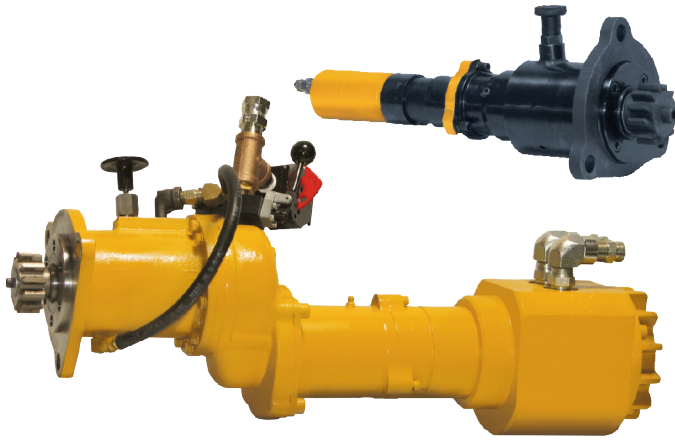
PARTS AND ACCESSORIES

	Part Number	Description		Part Number	Description
	SRV150	1 1/2" Relay Valve for Air Applications		ST1000-267-24	1 1/2" Strainer Housing
	SRV150SS	1 1/2" Gas Rated Relay Valve		ST1000-267-32	2" Strainer Housing
	150BMP-1064	1/8", 150 psi Pressure Gauge		ST1000-266-24	1 1/2" Strainer (40 mesh)
				ST1000-266-32	2" Strainer (40 mesh)

GENUINE INGERSOLL RAND REPLACEMENT KITS

Tune Up Kit Part Number	Description	Tune Up Kit Part Number	Description
TS1400	–	TS700	–
TS1400-TK1	Seal and O-Ring Kit	TS700-RM1	Bearing and O-Ring Kit (includes TS700-TK1)
TS1401-RM1	Seals, Bearings and 2-25% Arc Motors	TS700-TK1	O-Ring Kit
TS1401-RM2	Seals, Bearings and 2-99% Arc Motors	–	–
TS1401-RM3	Seals, Bearings and 2-35% Arc Motors	–	–
TS1401-RM4	Seals, Bearings and 2-50% Arc Motors	–	–
TS1401-TK1	Seal and O-Ring Kit	–	–

VERSATILE STARTING PERFORMANCE BARRING MOTORS



FEATURES/BENEFITS

- Reversible vane air motor for precise control
- Rugged design provides maximum durability and dependability
- Pendant control enables safer one-person operation
- B006 for diesel engines with displacements up to 100 liters and gas engines up to 200 liters
- T480 for diesel engines with displacements up to 500 liters and gas engines up to 1000 liters
- Integral disc brake on T480 is always engaged when motor is not in operation to ensure safer, easier engine adjustments

VERSATILE

- Available in two sizes
- Turns clockwise and counterclockwise at full power
- Can be used as a portable service tool or be permanently mounted to the engine
- Uses standard motor and pinion components
- Adjustable mounting flange allows multiple orientations



For engine displacement of:

Diesel—up to 30,500 CID (500 liters)

Carbureted—up to 61,000 CID (1000 liters)



BARRING MOTORS

PERFORMANCE INFORMATION

Pressure psi (bar)	Flange	Weight lb (kg)	Max Pressure (motor inlet) psi (bar)	Breakaway Torque ft-lb (Nm)	Speed at Max Power rpm	Description
B006						
B006PVR374-01**	01	19 (9)	90 (6)	152 (207)	23	Barring Motor Only
B006PVR374-03**	03	19 (9)	90 (6)	152 (207)	23	Barring Motor Only
B006PVR374-01-**P	01	25 (11)	90 (6)	152 (207)	23	Barring Motor with Pendant Control
B006PVR374-03-**P	03	25 (11)	90 (6)	152 (207)	23	Barring Motor with Pendant Control

**Pinion configurations: 15, 29, 31, 77, 79, 85, 94, 893, 895, 942. Additional flange and pinion configurations available upon request.

T480: INCLUDES INTEGRAL BRAKE						
T480PVRP-03**	03	58 (26)	90 (6)	322 (438)	65	Barring Motor Only
T480PVRP-03-**P	03	58 (26)	90 (6)	322 (438)	65	Barring Motor with Pendant Control

**Pinion configurations: 25, 29, 31, 83, 85, 87, 94, 893, 895, 942. Additional flange and pinion configurations available upon request.

PARTS AND ACCESSORIES

Part Number	Description
PB006-15K	B006 Pendant Control & 2 Hoses (15 in/4.6 m each)
PB006-30K	B006 Pendant Control & 2 Hoses (30 in/9 m each)
43551-2	Muffler for B006
PT480-15K	T480 Pendant Control & 3 Hoses (15 in/4.6 m each)
PT480-30K	T480 Pendant Control & 3 Hoses (30 in/9 m each)
3BM-A674	Muffler for T480



A B006PVR374-03-31P barring motor using pendant control, slow turning a Caterpillar 3408 engine.

START WITH THE BEST

ACCESSORIES

ACCESSORIES INDEX BY DESCRIPTION

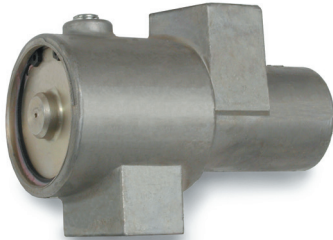
Accessory Description	Part Number	Page Number
Relay Valves		48-49
	SRV100	
	SRV125	
	SRV125T	
	SRV125F	
	SRV150	
	SRV150SS	
Relay Valve Tune Up Kit	SRV150-TK3	
Solenoid Control Valves		50
	150BMP-1051B	
	150BMP-2451B	
	150BMP-6451B	
	150BMP-A1051B	
Angle Mounting Bracket	150BMP-B2451	
Push Button Control Valves		51
	SMB-618	
	SMB-G618	
	SMB-619	
White Push Button Replacement Black Push Button Replacement	SMB-620	

Accessory Description	Part Number	Page Number
Air Strainers		52
	ST1000-267-16	
	ST1000-267-24	
	ST1000-267-32	
Mufflers		53
	ST500-674	
	SS800-A674	
In-Line Lubricators		54
	NL-8-8	
	NL-24-8	
Regulators		55
	NR-24-8	
NR-24-8 Tune Up Kit	NR24-TK1	

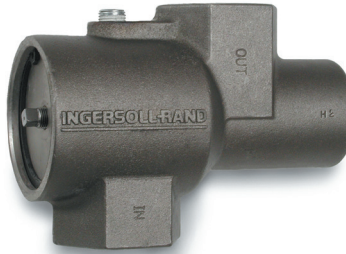
ACCESSORIES

RELAY VALVES

Ingersoll Rand relay valves provide immediate response to assure air starter disengagement and prevent damage to the pinion or flywheel ring gear. The aluminum die cast housing resists abrasion and corrosion while the stainless steel piston return spring will not rust from moisture in the air line.



SRV150



SRV150SS



SRV125F-P

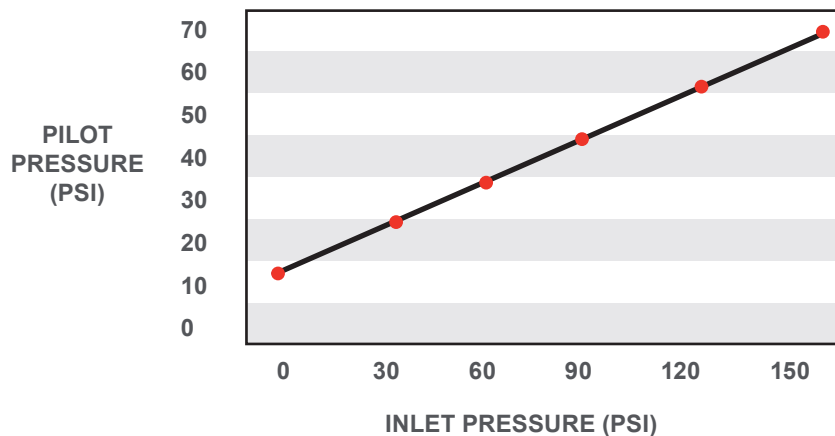
SPECIFICATIONS

- Maximum Operating Pressure = 225 psi (15.5 bar)
- Operating Temperature Range = -20 to 250°F (-29 to 121°C)
- Flow/Pressure Drop $C_v = 37$

RELAY VALVES

Part Number	NPT Size Inlet – Outlet	Weight lb (kg)	Description
SRV100	1" – 1"	3.10 (1.41)	SS100 Relay Valve
SRV125	1¼" – 1¼"	2.90 (1.32)	150BM, SS350G, 150T Relay Valve
SRV125T	1¼" – 1¼"	2.90 (1.32)	150BM, SS350G, 150T Relay Valve for Transportation
SRV150	1½" – 1½"	2.70 (1.22)	SS800, ST700, ST900, ST600 Relay Valve
SRV150SS	1½" – 1½"	7.15 (3.24)	SS800, ST700, ST900 Relay Valve for Natural Gas Use
SRV125F-P	1¼" Flanged	7.40 (3.36)	150T/150BM 150T/150BM Flange Mount Relay Valve

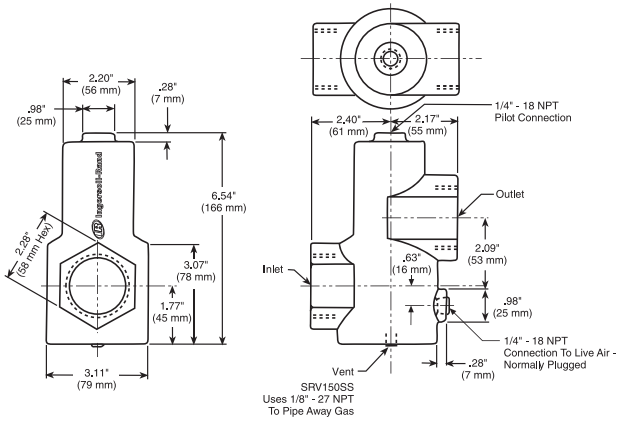
INLET PRESSURE VS. PILOT PRESSURE TO OPEN



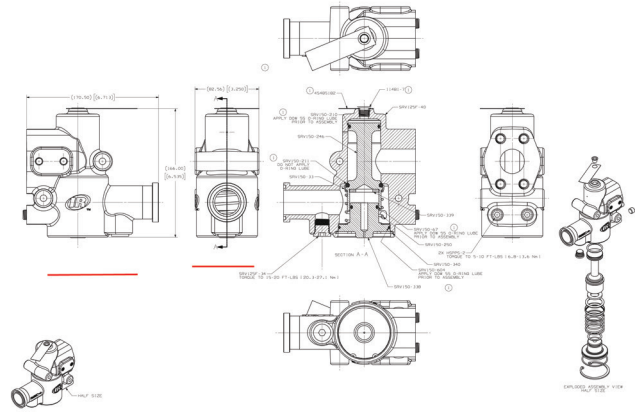
ACCESSORIES

DIMENSIONS

Note: All dimensions shown are for reference only. Specifications subject to change without notice.



SRV150

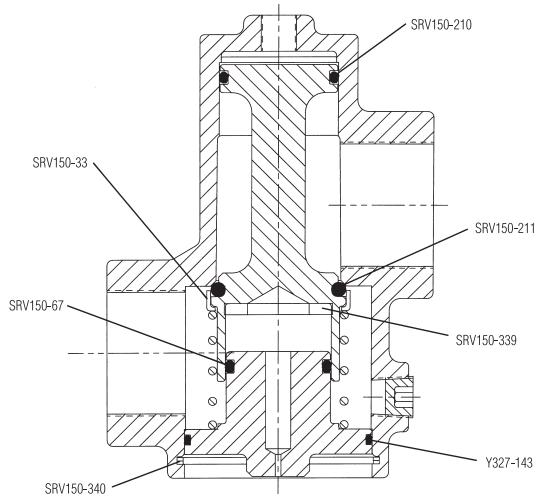


SRV125F-P

GENUINE INGERSOLL RAND REPLACEMENT KITS

Tune Up Kit Part Number	Description
SRV150-TK3	For use with SRV100, SRV125, SRV125T, SRV150, and SRV150SS Relay Valves

PARTS



Cross-Section of SRV150-TK3 Part Location



SRV-TK3 Parts

ACCESSORIES

SOLENOID CONTROL VALVES

These DC actuated valves are designed for pilot operation of the Ingersoll Rand relay valve and are approved for applications affected by the U.S. Department of Transportation safety codes.

SPECIFICATIONS

- Valve Type: Three-way normally closed C_v Factor: 0.21
- Power Consumption: 25 watts
- Operating Pressure Range: 0 to 300 psig (0 to 20.7 bar)
- Proof Pressure: 375 psig (25.9 bar)
- Burst Pressure: 1250 psig (86.2 bar)
- Media: Air, inert gases, water, light oils
- Media Temperature: -4 to 392°F (-20° to 200°C)
- Ambient Temperature: -4 to 248°F (-20° to 120°C)
- Seal Material: Viton



150BMP-2451B

150BMP SOLENOID CONTROL VALVES

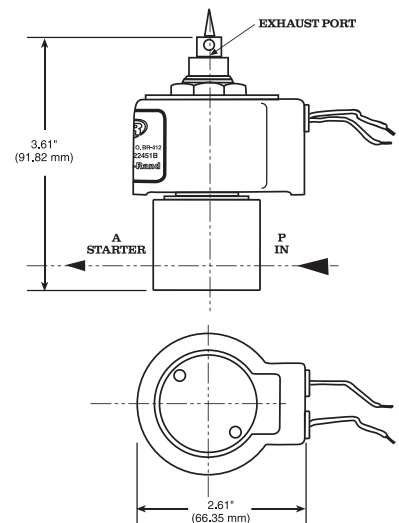
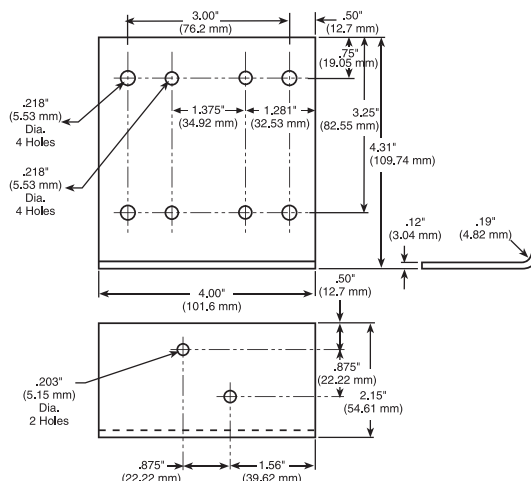
Part Number	Thread Size Inlet – Outlet	Voltage (DC)	Weight lb (kg)	Description
150BMP-1051B*	1/4" – 1/4"	12 volt	1.95 (.88)	24" (61 cm) Long Wire Leads
150BMP-2451B*	1/4" – 1/4"	24 volt	1.95 (.88)	24" (61 cm) Long Wire Leads
150BMP-6451*	1/4" – 1/4"	64 volt	1.95 (.88)	24" (61 cm) Long Wire Leads
150BMP-A1051C*	1/4" – 1/4"	12 volt	1.95 (.88)	Pioneer Connector Lead

*Can be mounted on 150BMP-B2451 elbow bracket.

DIMENSIONS

150BMP-B2451
MOUNTING
BRACKET
Weight: .39 lbs (.17 kg)

Note: All dimensions shown are for reference only. Specifications subject to change without notice.



ACCESSORIES

PUSH BUTTON CONTROL VALVES

The Ingersoll Rand manually actuated push button control valve is designed for pilot operation of the relay valve. Simple and reliable, this valve readily mounts in a 7/8" diameter hole on dashboards or control panels. The chrome-plated SMB-G618 valve is available for use in marine, offshore and natural gas applications, while the brass bodied SMB-618 valve is suitable for air applications only.

SPECIFICATIONS

- Operating Temperature Range: -40 to 200°F (-40 to 93.3°C)
- Maximum Operating Pressure: 225 psi (15.5 bar)



SMB-618



SMB-G618



SMB-620
Black Push Button

PUSH BUTTON CONTROL VALVES

Part Number	NPT Size Inlet – Outlet	Weight lb (kg)	Description
SMB-618	1/8" – 1/8"	.47 (.21)	Air-approved Push Button Valve
SMB-G618	1/8" – 1/8"	.48 (.21)	Gas-approved Push Button Valve

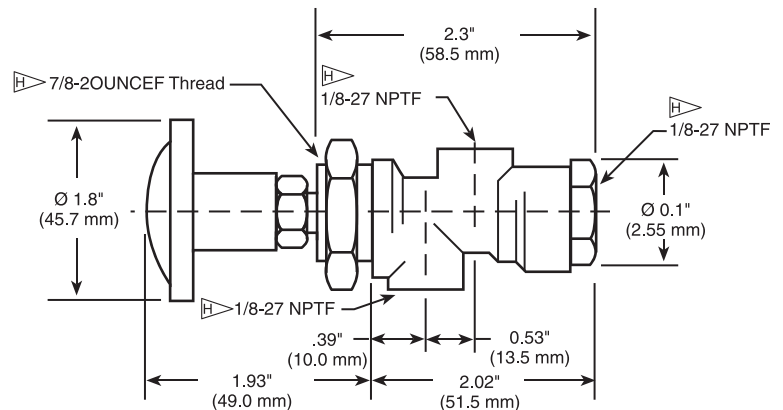
INGERSOLL RAND REPLACEMENT PARTS

Part Number	NPT Size Inlet – Outlet	Weight lb (kg)	Description
SMB-619	.25" – 28 UNF	.05 (.02)	White Push Button
SMB-620	.25" – 28 UNF	.05 (.02)	Black Push Button

DIMENSIONS

SMB-G618

Note: All dimensions shown are for reference only. Specifications subject to change without notice.



ACCESSORIES

AIR STRAINERS

Ingersoll Rand strainers are used in the air line to assure long starter life where air or gas is contaminated. The ST1000 strainer screens the starter air utilizing a 300-mesh element reinforced on two sides by a 20-mesh internal stainless steel screen to ensure air integrity. The ST1000 strainers have stainless steel bodies and utilize 40-mesh stainless steel screens.

MAXIMUM WORKING PRESSURE

Saturated Steam	Water, Oil, Gas	Compressed Air
250 psi @ 400°F	400 psi @ 150°F	500 psi @ 150°F
15.5 bar @ 204°C	27.6 bar @ 66°C	34.4 bar @ 66°C



Strainer Housing

ST1000-267-16
ST1000-267-24
ST1000-267-32



Strainer Element

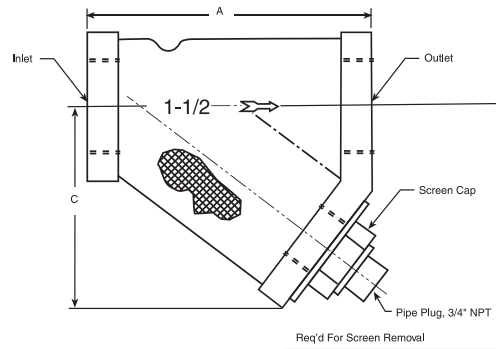
ST1000-266-16
ST1000-266-24
ST1000-266-32

ST1000 AIR STRAINERS (HOUSING + STRAINER ELEMENT)

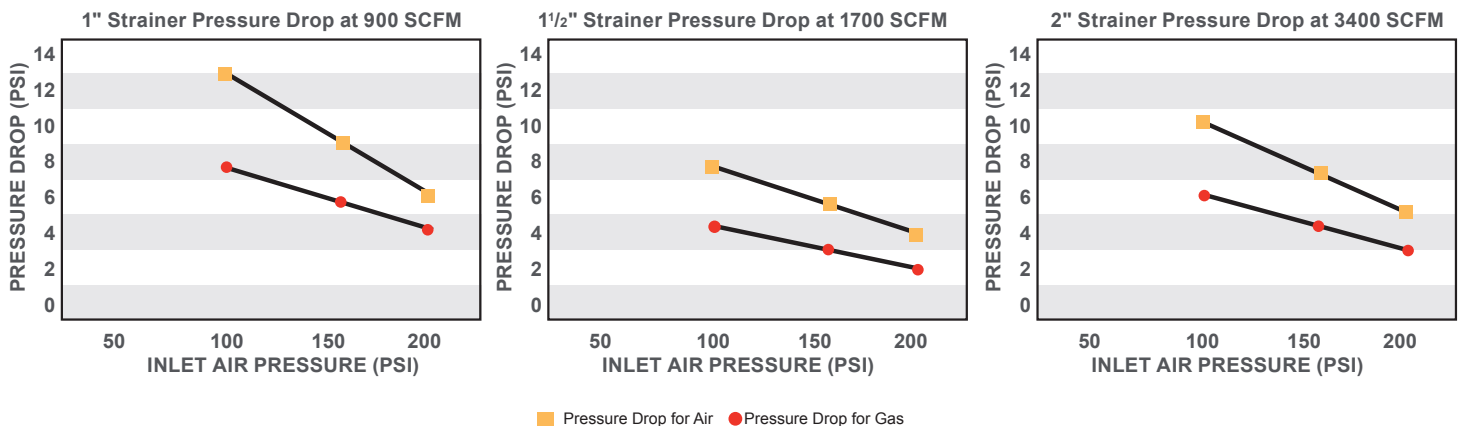
Part Number	Thread Size Inlet - Outlet (NPT)	Weight lb (kg)	Strainer Element Replacement Part #
ST1000-267-16	1" – 1"	3.00 (1.36)	ST1000-266-16
ST1000-267-24	1½" – 1½"	2.66 (1.21)	ST1000-266-24
ST1000-267-32	2" – 2"	3.92 (1.78)	ST1000-266-32

DIMENSIONS

Part Number	Dim. A in. (mm)	Dim. B in. (mm)	Dim. C in. (mm)
ST1000-267-16	4.00 (101.4)	3.25 (82.6)	2.62 (66.5)
ST1000-267-24	4.72 (120.0)	5.00 (127.0)	2.99 (76.0)
ST1000-227-32	5.51 (140.0)	6.125 (155.6)	3.54 (89.9)



Note: All dimensions shown are for reference only. Specifications subject to change without notice.



ACCESSORIES

MUFFLERS

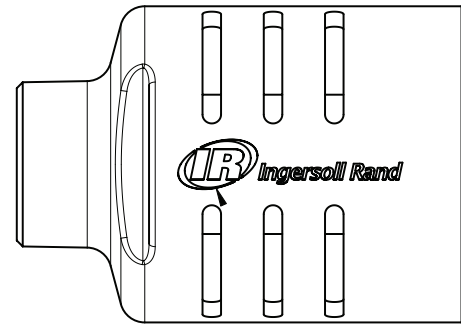
Ingersoll Rand mufflers are designed to effectively limit starting noise levels.

SPECIFICATIONS

- Low back pressure provides minimal power loss for full starter power
- Effective sound attenuation for low noise level
- Non-freezing for reliable operation
- Capable of direct or remote mounting for flexibility of application

DIMENSIONS

Note: All dimensions shown are for reference only. Specifications subject to change without notice.



MUFFLERS

Part Number	NPT Size	Dim. A in. (mm)	Dim. B in. (mm)	Weight lb (kg)	For Model Series
150BM-A674	1 1/4"	4.21 (106.9)	3.34 (84.8)	1.50 (0.68)	150BM, SS175
SS350-A674	1 1/2"	4.56 (115.8)	3.31 (84.1)	1.13 (0.50)	SS350
150T-312	2"	5.50 (139.7)	2.75 (69.85)	1.85 (0.84)	150T, ST500
SS800-A674	2 1/2"	6.66 (169.21)	4.75 (120.77)	3.35 (1.52)	SS800



150BM-A674



SS350-A674



150T-312



SS800-A674

ACCESSORIES

IN-LINE LUBRICATORS

SPECIFICATIONS

- Reservoir: 1/2 Pint Metal
- Maximum Operating Temperature = 175°F (79°C)
- Maximum Operating Pressure = 250 psi (17.2 bar)
C = 26
- Media: Air, clean natural gas (see circular letter A-1077)
- Recommended Operating Flow Range at 100 psig (6.9 bar): 160 to 600 scfm (78 to 283 dm³/s)
- Recommended Lubricants: This lubricator will perform satisfactorily using misting type oils rated 150 to 200 SSU (Saybolt seconds) @ 110°F (38°C)
- Material Construction:
 - Body = Aluminum — Reservoir = Steel
 - Sight-Feed Dome = Pyrex & Aluminum
 - Elastomers = Neoprene & Buna-N

INSTALLATION

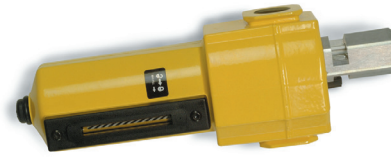
- Air line piping should be same size as lubricator ports.
- Install lubricator vertically (sight-feed dome up) in air line downstream of filter and regulator as near as possible to the device being served. This lubricator may be installed upstream or downstream of directional control valves.
- Connect piping to proper ports using pipe thread sealant on male threads only. Do not allow sealant to enter interior of lubricator. Air flow must be in direction of arrow on side of body.
- Remove fill plug and fill reservoir with a good quality lubricant to 3/4" below bottom of threads on dipstick. Do not overfill.

Warning

These units must not be used where pressure or temperature may exceed maximum rated operating conditions. See specifications.
In lubrication applications, some oil mist may escape from the point of use into the surrounding atmosphere. Users are referred to OSHA safety and health standards for limiting oil mist contamination and utilization of protecting equipment.

IN-LINE LUBRICATORS

Part Number	Port Thread Size NPT Inlet – Outlet	Weight lb (kg)
NL-8-8	1/2" – 1/2"	1.70 (.77)
NL-24-8	1 1/2" – 1 1/2"	2.70 (1.22)
NL24-TK1	N/A	.05 (.02)



NL-8-8

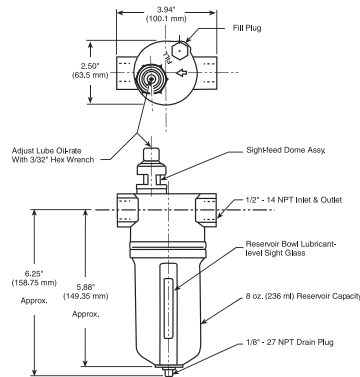


NL-24-8

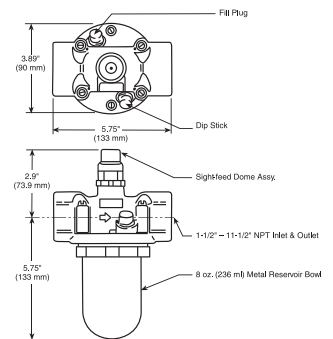
ADJUSTMENT

- Adjust drip rate only when there is a constant rate of flow through the lubricator.
- Determine the average rate of air flow (scfm) through the lubricator, then adjust the needle valve using a 3/32" allen wrench to obtain the recommended drip rate (Drops/min).
- Turn needle valve counterclockwise to increase and clockwise to decrease the drip rate.
- Monitor the device being lubricated for a few days following initial adjustment. Readjust the drip rate if the oil delivery at the device appears either excessive or low.

NL-8-8



NL-24-8



RECOMMENDED DRIP RATE

Recommended Drip Rate Settings for Average Lubrication

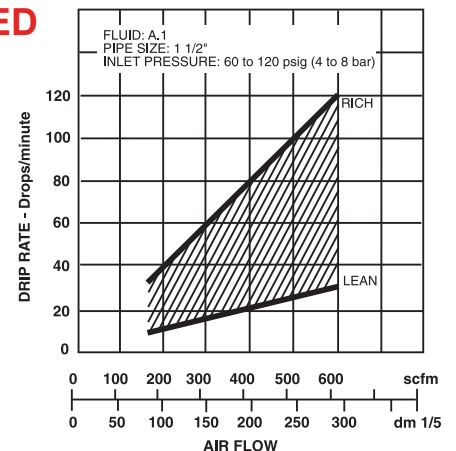


FIGURE 1 Recommended Drip Rate Settings for Average Lubrication

ACCESSORIES

REGULATORS

RATED OPERATING CONDITIONS

- Inlet Pressure: 10 to 450 psig (0.7 to 31 bar)
- Maximum Outlet Pressure: 250 psig (17.2 bar)
- Temperature: 0° to 175°F (-18° to 79°C)
 - With dewpoint less than air temperature below 35°F (2°C)
- Air Consumption: 2200 scfm @ 150 psi

SPECIFICATIONS

- Fluid: Compressed Air
- Type: Relieving
- Ports: Main: 1-1/2" or 2" NPT
 - Gauge: 1/4" NPT
 - Exhaust (relieving models only): 3/4" NPT
- Outlet Pressure Adjustment Range:
 - 10 to 250 psig (0.7 to 17.2 bar)
- Threads: Use SMB-441 sealant on threads of air line fittings. Apply sealant evenly to threads only. Excessive sealant may interfere with valve operation.



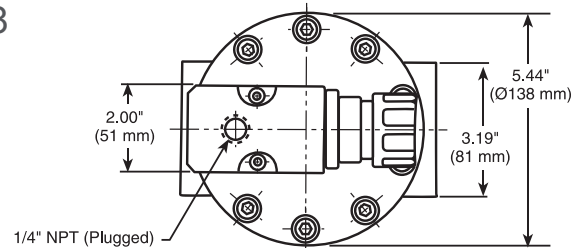
NR-24-8
Pilot Operated
Regulator with
Integral Pilot

Outlet pressure adjustment ranges are not minimum or maximum outlet pressure limits. Regulators can be adjusted to zero psig outlet pressure and, generally, to pressures in excess of those specified.

The use of these regulators to control pressures outside of the specified ranges is not recommended.

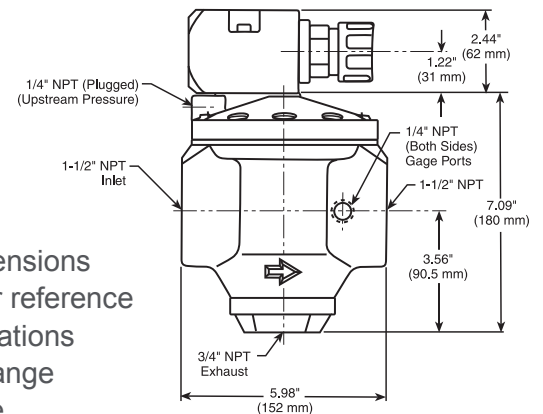
DIMENSIONS

NR-24-8



REGULATORS

Part Number	Description
NR-24-8	Pilot Operated Regulator with Integral Pilot (1 1/2" NPT)
NR-24-8-2	Pilot Operated Regulator with Integral Pilot (2" NPT)
NR24-TK1	NR-24-8 Tune Up Kit



Note: All dimensions shown are for reference only. Specifications subject to change without notice.

AT YOUR SERVICE

INSTALLATION CONFIGURATIONS

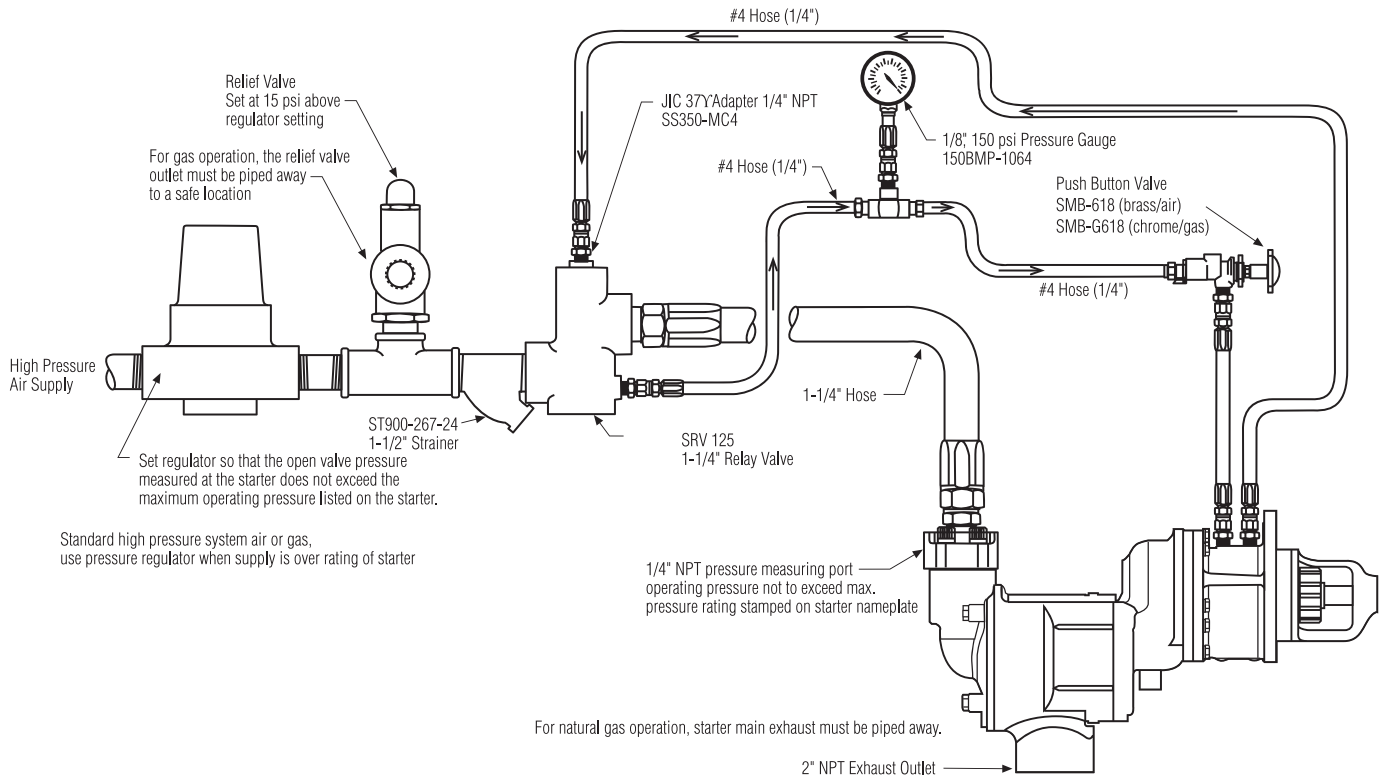
SERIES/INSTALLATION CONFIGURATION

	Page Number
150/ST500 Stationary (Gas)	57
ST400	57
ST700/ST900/ST1000 Inertia	58
ST600/ST700/ST900/ST1000 Stationary	58
ST600/ST700/ST900/ST1000 Multiple Starter	59
150BMP/SS100	60
SS350/150MPE Stationary	60
SS350/150BMPE Vehicular	61
150BMG (Gas) Stationary	61
SS810 Stationary	62
SS815/SS825/SS850 Stationary	62

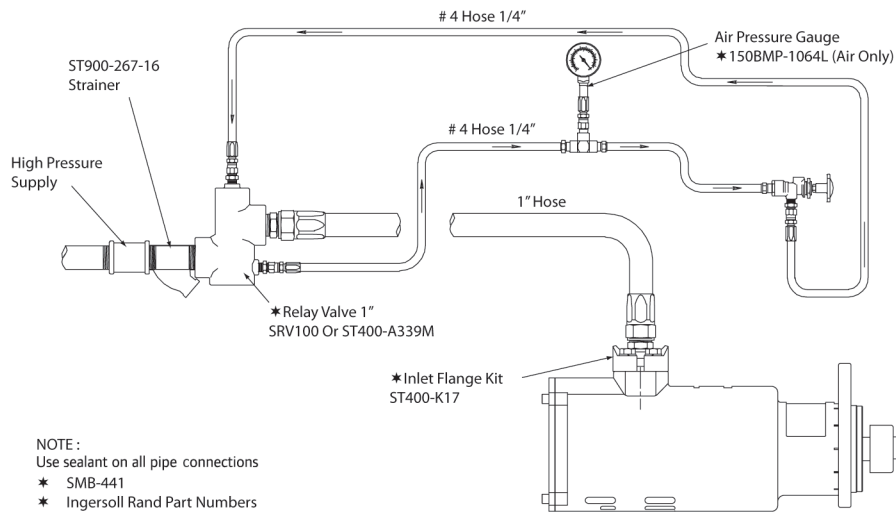


INSTALLATION CONFIGURATIONS

150 & ST500 STATIONARY - GAS

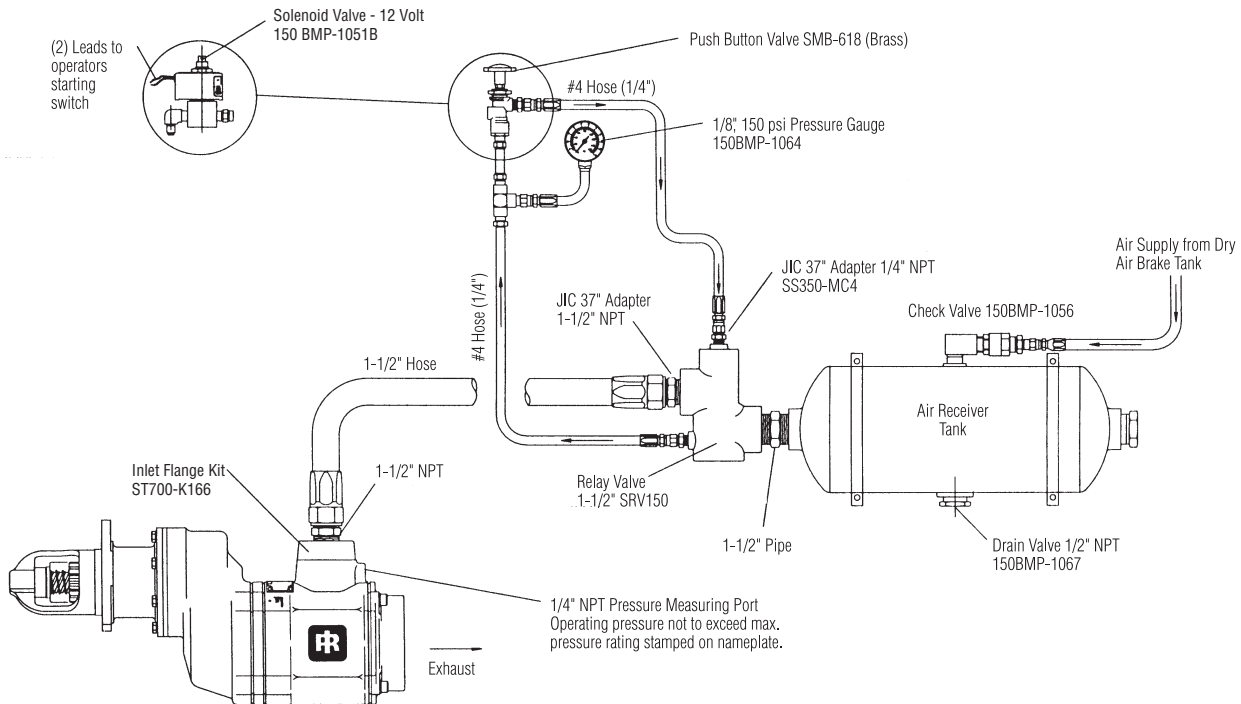


ST400 INSTALLATION

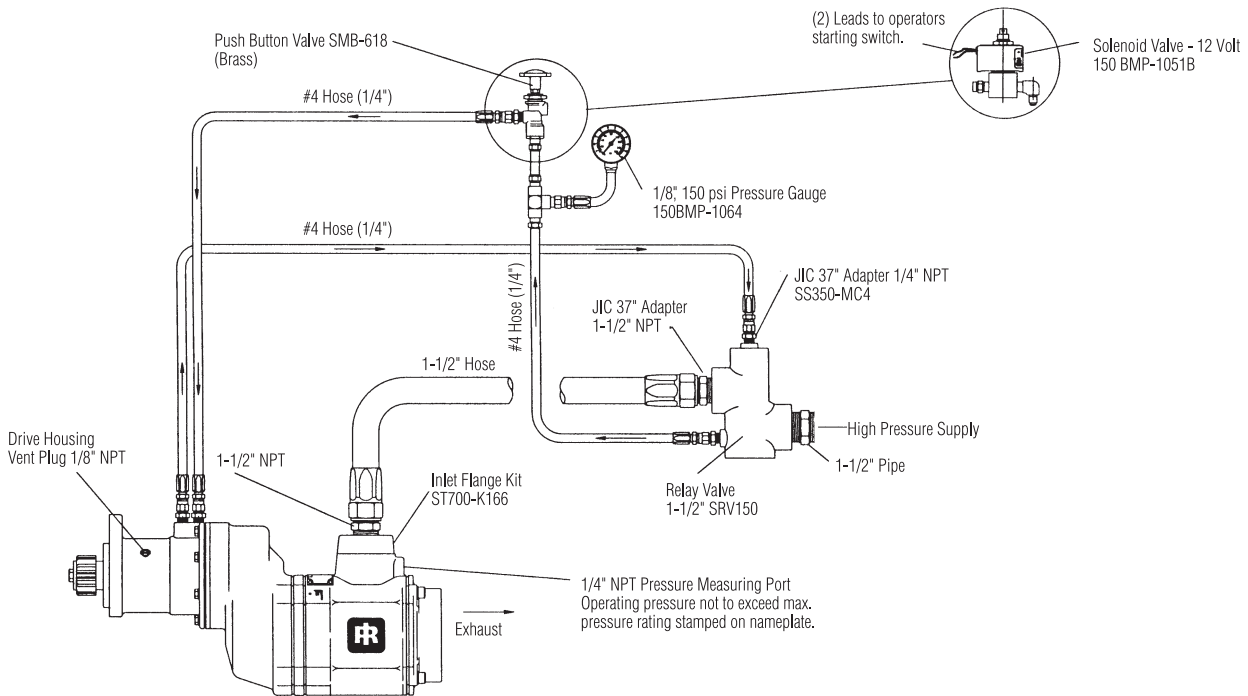


INSTALLATION CONFIGURATIONS

ST600/ST700/ST900/ST1000 INERTIA INSTALLATION

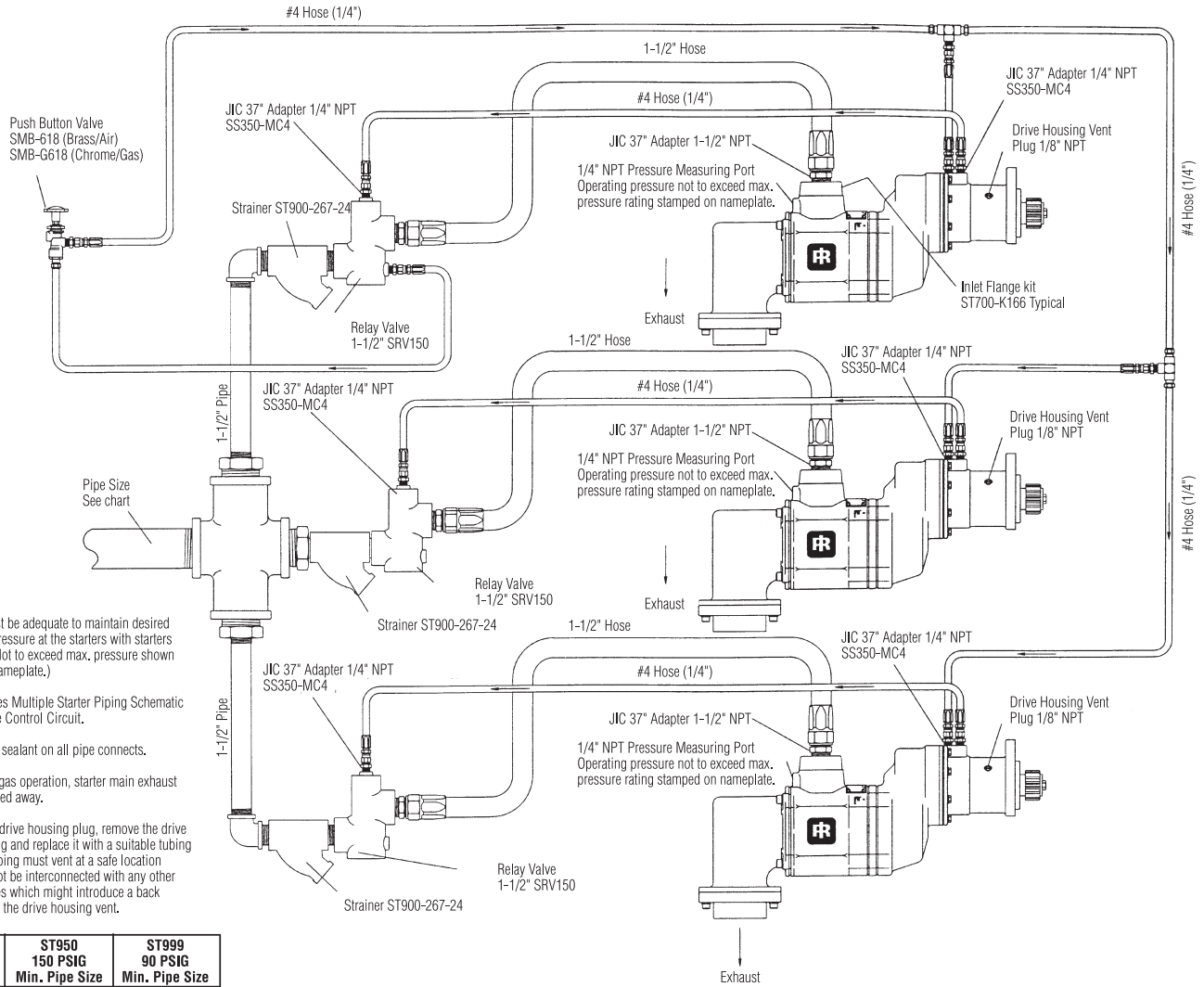


ST700/ST900/ST1000 TYPICAL STATIONARY INSTALLATION



INSTALLATION CONFIGURATIONS

ST700/ST900/ST1000 TYPICAL MULTIPLE STARTER APPLICATION INSTALLATION



Supply must be adequate to maintain desired operating pressure at the starters with starters running. (Not to exceed max. pressure shown on starter nameplate.)

ST900 Series Multiple Starter Piping Schematic showing the Control Circuit.

NOTE: Use sealant on all pipe connects.

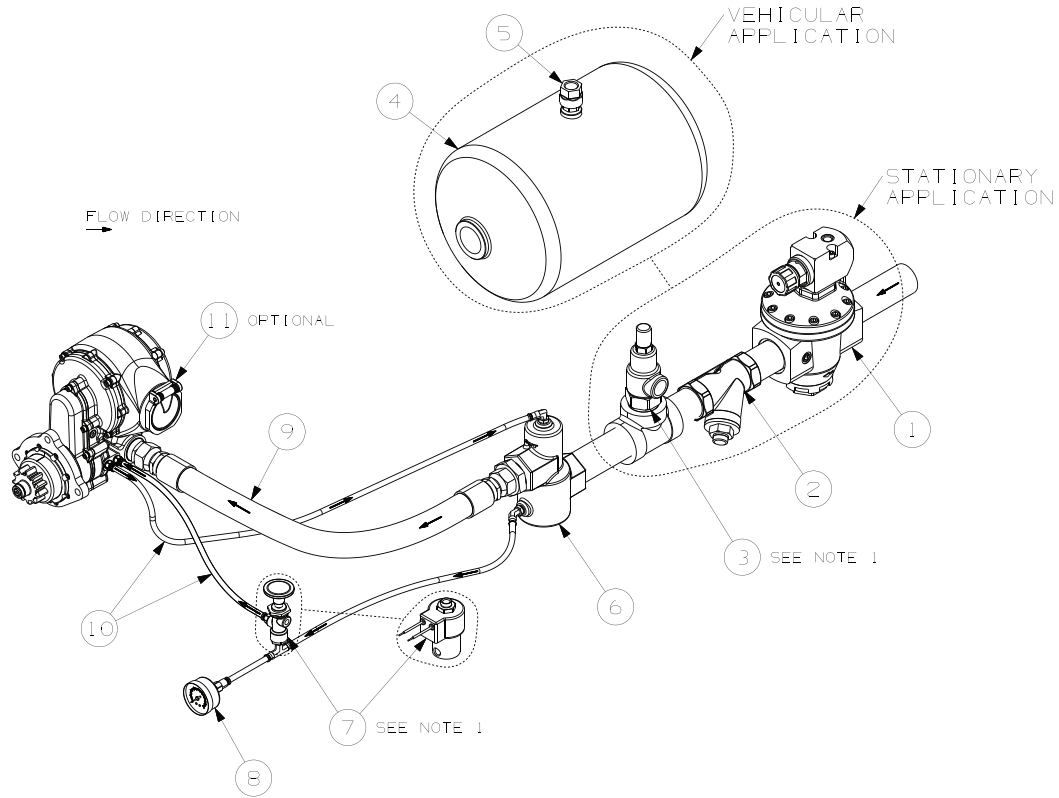
For natural gas operation, starter main exhaust must be piped away.

To pipe the drive housing plug, remove the drive housing plug and replace it with a suitable tubing line. The tubing must vent at a safe location and must not be interconnected with any other exhaust lines which might introduce a back pressure on the drive housing vent.

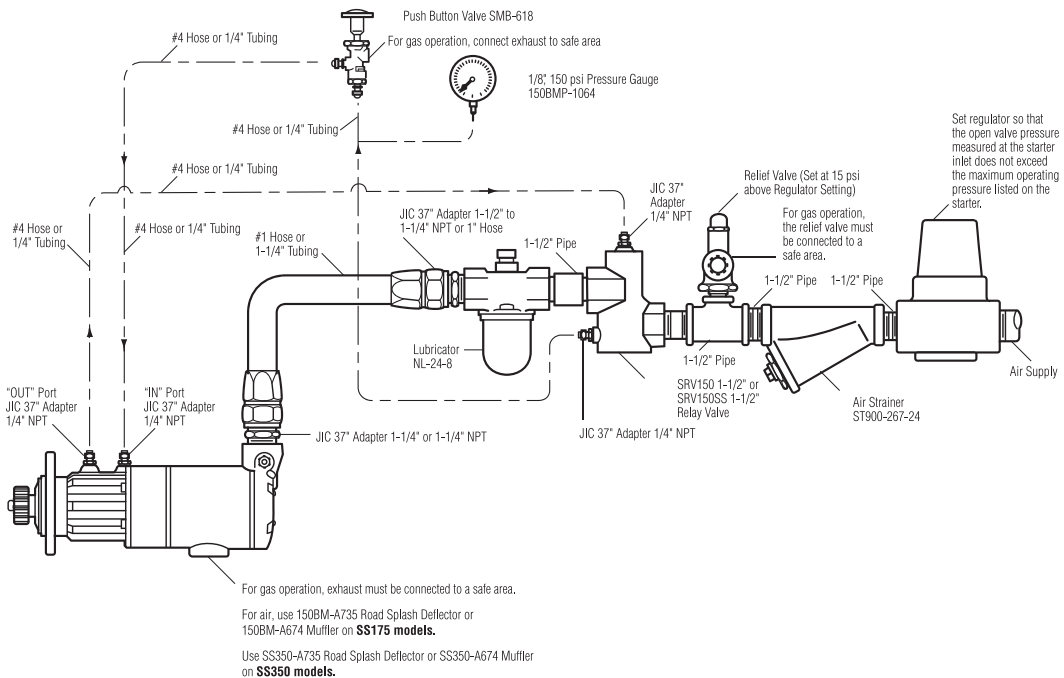
No. of Starters	ST950	ST999
	150 PSIG	90 PSIG
	Min. Pipe Size	Min. Pipe Size
2	2-1/2"	3"
3	3"	3-1/2"
4	3-1/2"	4"
5	3-1/2"	4"

INSTALLATION CONFIGURATIONS

150BMP AND SS100 TYPICAL INSTALLATIONS

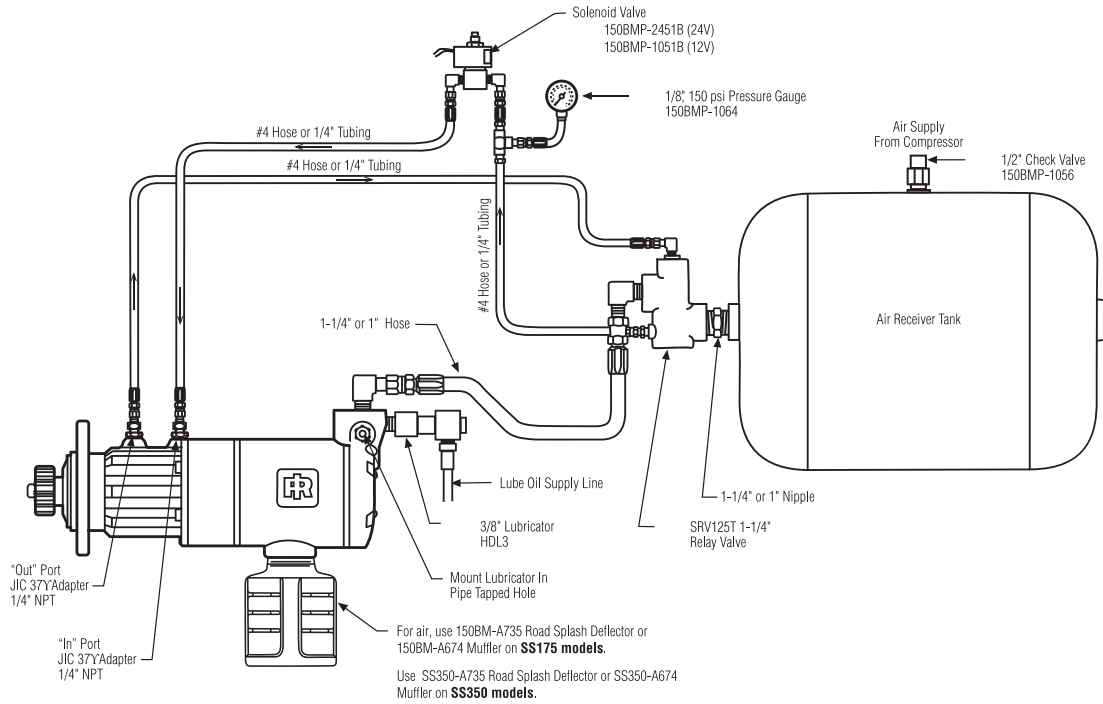


SS350/150MPE STATIONARY INSTALLATION

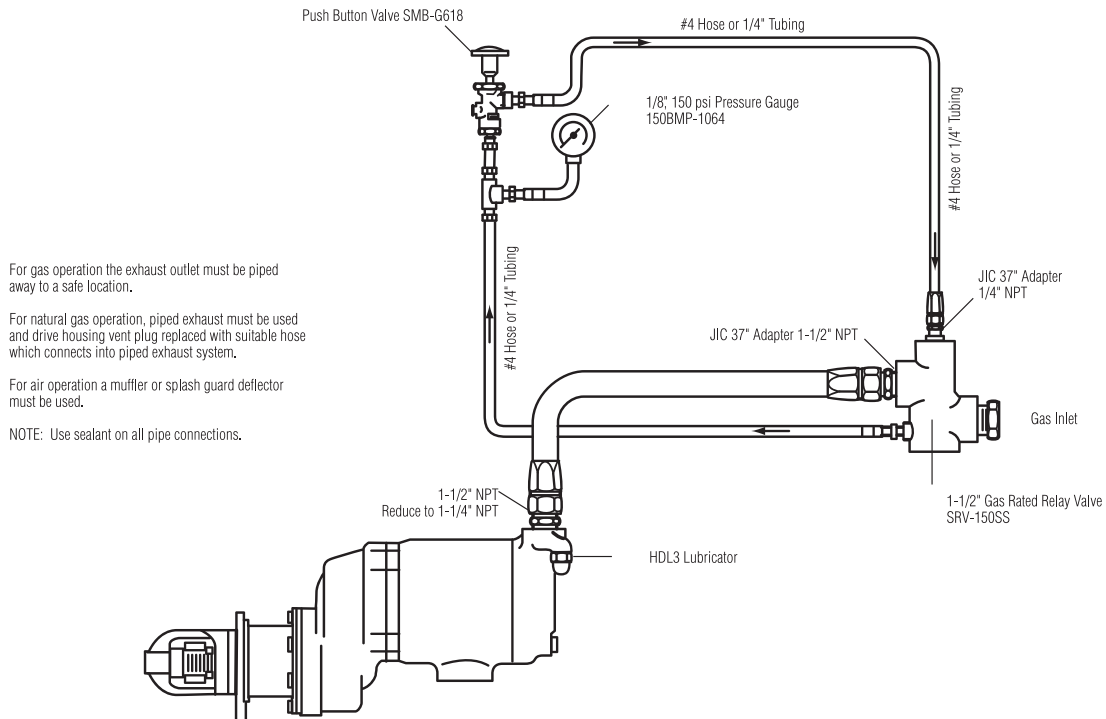


INSTALLATION CONFIGURATIONS

SS350/150BMPE TYPICAL VEHICULAR INSTALLATION

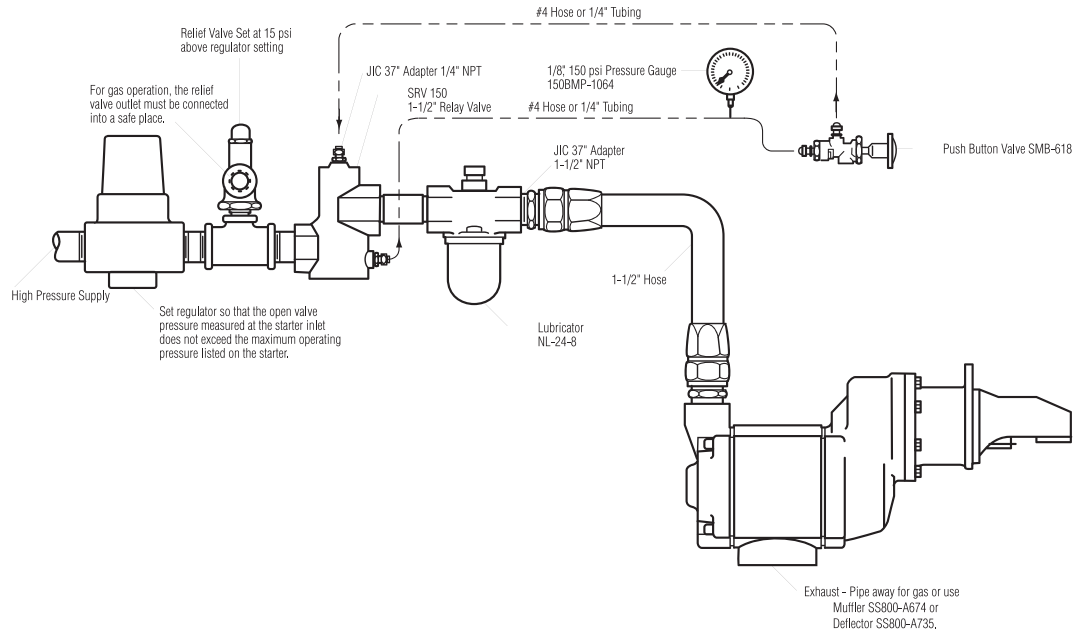


150BMG (GAS) STATIONARY INSTALLATION

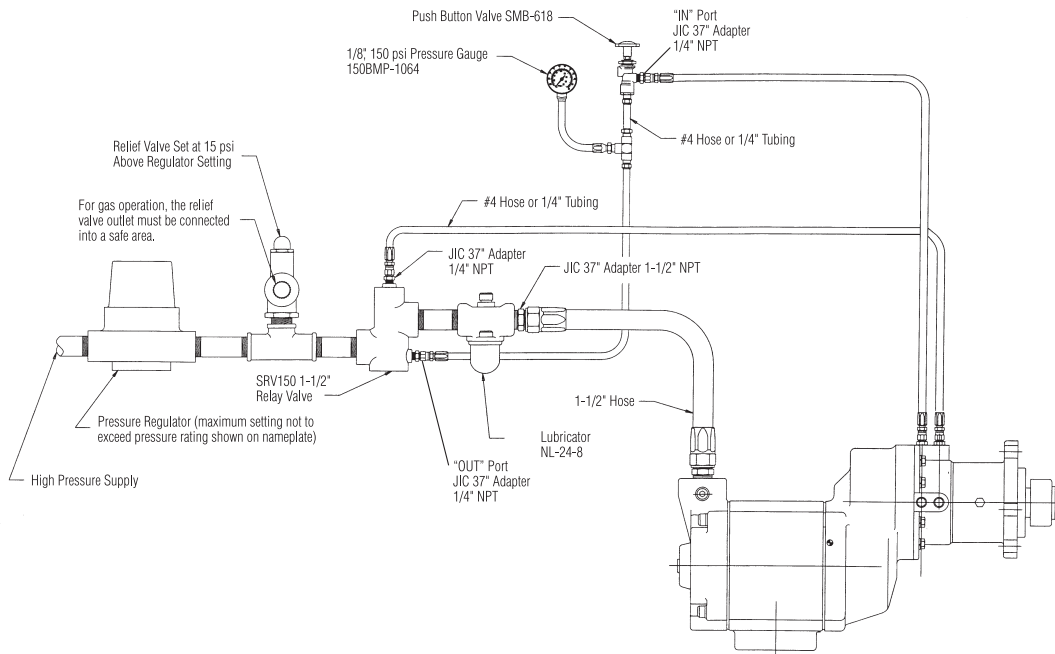


INSTALLATION CONFIGURATIONS

SS810 TYPICAL STATIONARY INSTALLATION



SS815/SS825/SS850 TYPICAL STATIONARY INSTALLATION



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Ingersoll Rand (NYSE:IR), driven by an entrepreneurial spirit and ownership mindset, is dedicated to helping make life better for our employees, customers and communities. Customers lean on us for our technology-driven excellence in mission-critical flow creation and industrial solutions across 40+ respected brands where our products and services excel in the most complex and harsh conditions. Our employees develop customers for life through their daily commitment to expertise, productivity and efficiency.