

ENGINE STARTING SYSTEMS

Document : Technical Documentation

Subject : RR150 Maxi Regulator

Author : H.B / BDD

Ingersoll-Rand

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RR150 STARTER RELAY VALVE WITH PRESSURE CONTROL



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TABLE OF CONTENTS

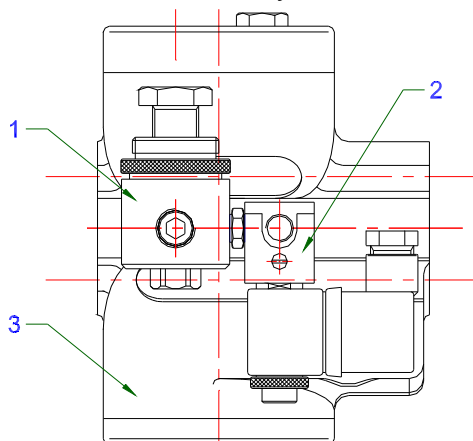
1.	Description :	3
2.	Operation:	5
3.	Schematics :	6
4.1	For Inertia drive Applications :	6
4.2	For Pre-engaged drive Applications:	7
4.	Specifications :	8
5.1	Master Regulator :	8
5.2	Slave Regulator :	8
5.	Materials of construction :	9
6.1	Master Regulator.....	9
6.2	Slave Regulator :	9
6.	Performance Rating :	10
7.	Nomenclature :	10
8.	Installation - Maintenance and Recommendations:	11
9.	Slow cranking device	15
10.	Dimensional drawing and part list:	16
10.1	RR150	16
10.2	RR150-F30	18
10.3	RR150-F30-B	20
10.3	RR150-F30-D	22

1. Description :

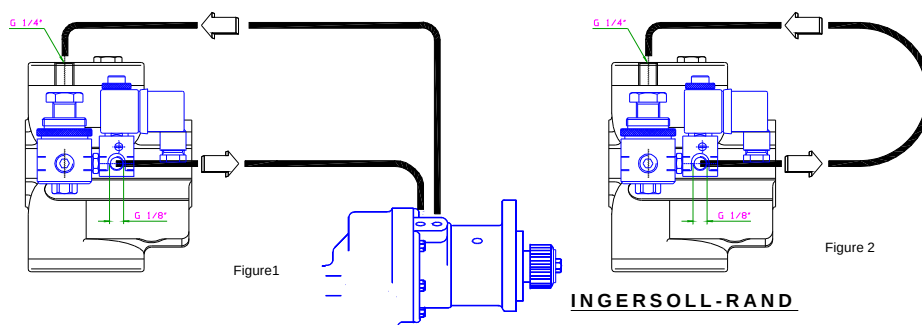
The RR150-F30 is a device which include valve and regulator functions.

The RR150-F30 is made of three main components :

1. The master regulator which will give the Pilot pressure.
2. The solenoid valve which will open or close the system when the operator will actuate the switch key.
3. The Slave Regulator which is in fact the main body.



The slave regulator (1) will receive the signal from the Master regulator (1) through the solenoid valve (Fig 2). For pre-engage Starters (fig 1) the signal pressure will come from the Master regulator through the solenoid valve to the Pilot « In » port of the air starter drive housing, giving the signal to engage the Drive Pinion into the ring gear. After engaging the Drive Pinion it will come out through the « Out » port of the Drive Housing and will go to the top cover of the Slave regulator.



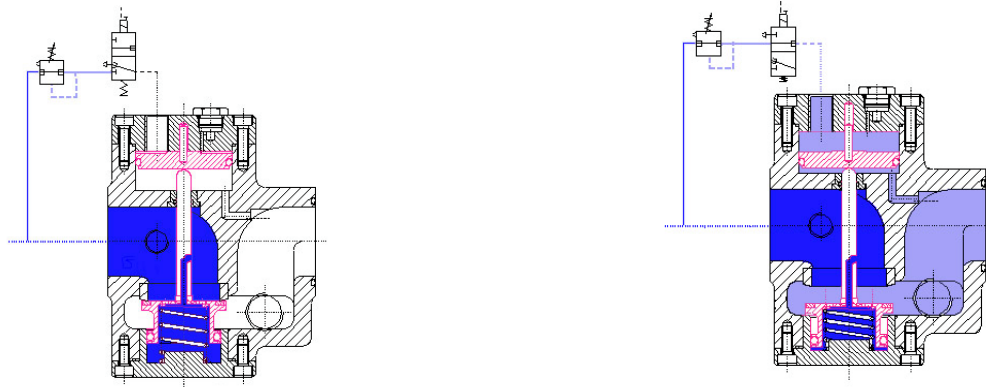
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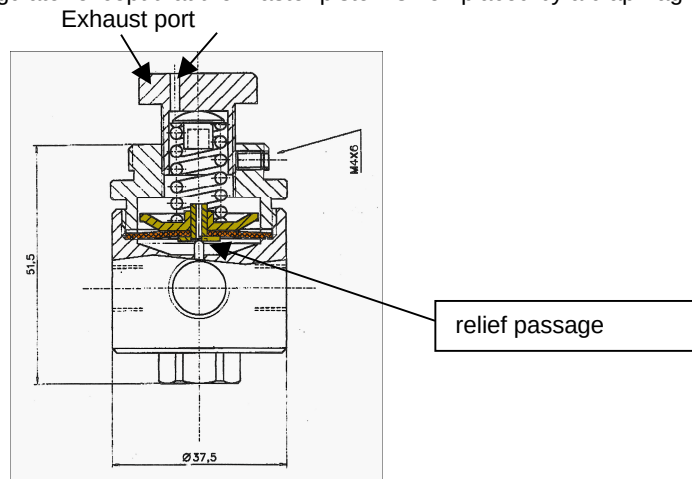
Ingersoll-Rand

Created : 10/16/98
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Version : 5C

The Slave regulator using the pressure signal on top of the Master Piston will force valve Stem off its seat and allows air to flow into control chamber below the Master Piston, through the Outlet port of the RR150 valve to the Starter Motor .Outlet pressure increase in the downstream system and sensing chamber (under Master Piston) and applies an upward force on bottom of the Master Piston. The Piston and valve move upward. Upward movement stop when the forces below the Piston balance the force above the Piston.



The RR150-F30 can be adjusted even when the solenoid valve is not actuated. The master regulator works using the same concept as the slave regulator except that the master piston is replaced by a diaphragm associated to a spring and an adjusting knob.



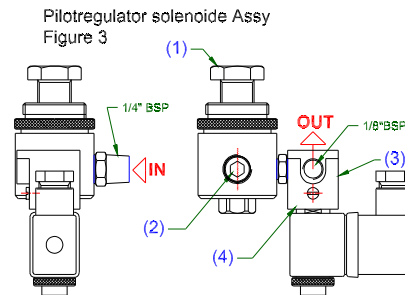
Clockwise rotation of the knob will increase pressure of the spring on the diaphragm. This will increase the air pressure at the outlet port of the master regulator. When the solenoid valve is closed, there is no demand, the balance of forces occurs immediately in this condition. When the solenoid valve open, there is downstream demand, the balance of forces occurs when the valve opens sufficiently to compensate for demand, thus maintaining the desired outlet pressure

When the adjusting knob is turned counter clockwise, the pressure above the diaphragm of the Master regulator is reduced and the air pressure under the diaphragm move upward. This upward movement opens the relief passage in the armature of the diaphragm of the master regulator and allows air to escape through the exhaust port, on top of the knob, to atmosphere.

The exhaust port must not be plugged. If it is plugged, the relief feature will become inoperative

2. Operation:

Clockwise rotation of knob (1) will open the seat pilot regulator and will build up pressure between slave regulator and solenoid valve (4). Turn the knob since you have not reach the working pressure. Never exceed 10 bar or 145 psig. The pressure you will adjust at the slave regulator will be the working pressure at the starter in order to adjust easily the working pressure install a gauge on port (2) or port (3).



The Master pressure regulator is design with a relieving valve. When the pressure below the diaphragm is reaching 0,8 bars over the adjusted pressure the valve exhaust the excess of pressure. The Knob (1) is drill with a 2mm hole in order to escape the excess of pressure, do not plug this exhaust port. In case the end user is over tightening the knob the relieving function will no longer work properly, Ingersoll-Rand recommend the following:

For maximum outlet pressure adjustment up to 8 bars Use spring model RR100-R030-10

For maximum outlet pressure adjustment up to 10,5 bars use spring model RR100-R030-16.

ENGINE STARTING SYSTEMS

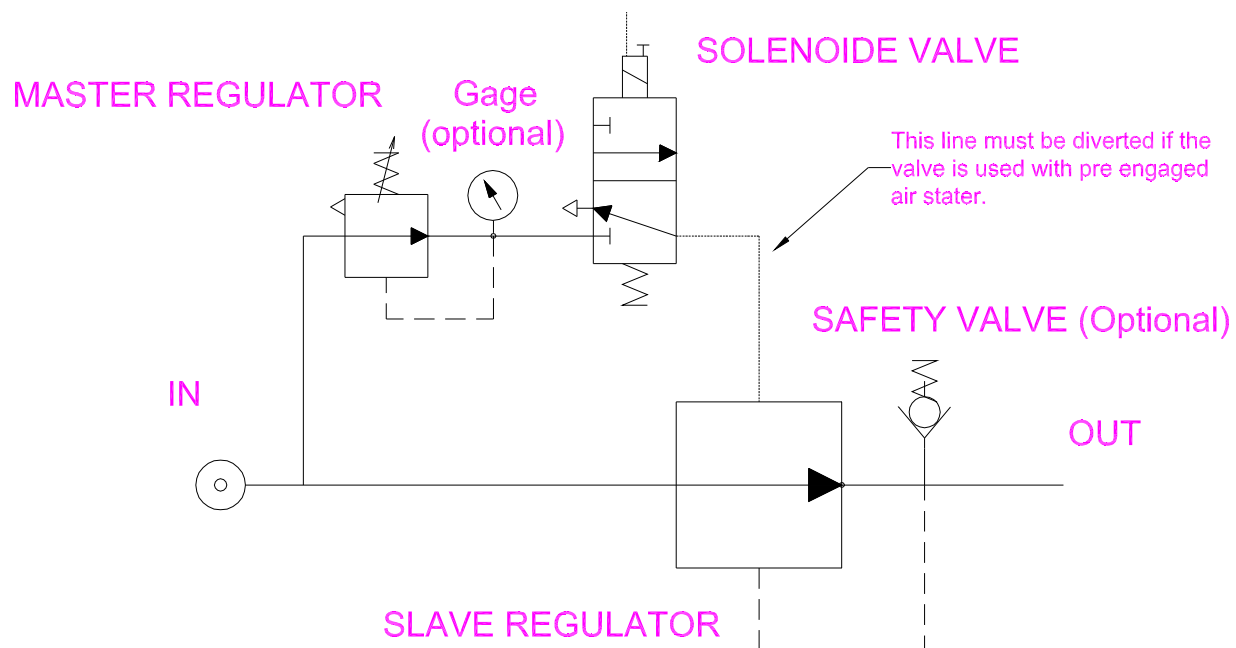
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Ingersoll-Rand

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Version : 5C

3. Schematics :

4.1 For Inertia drive Applications :



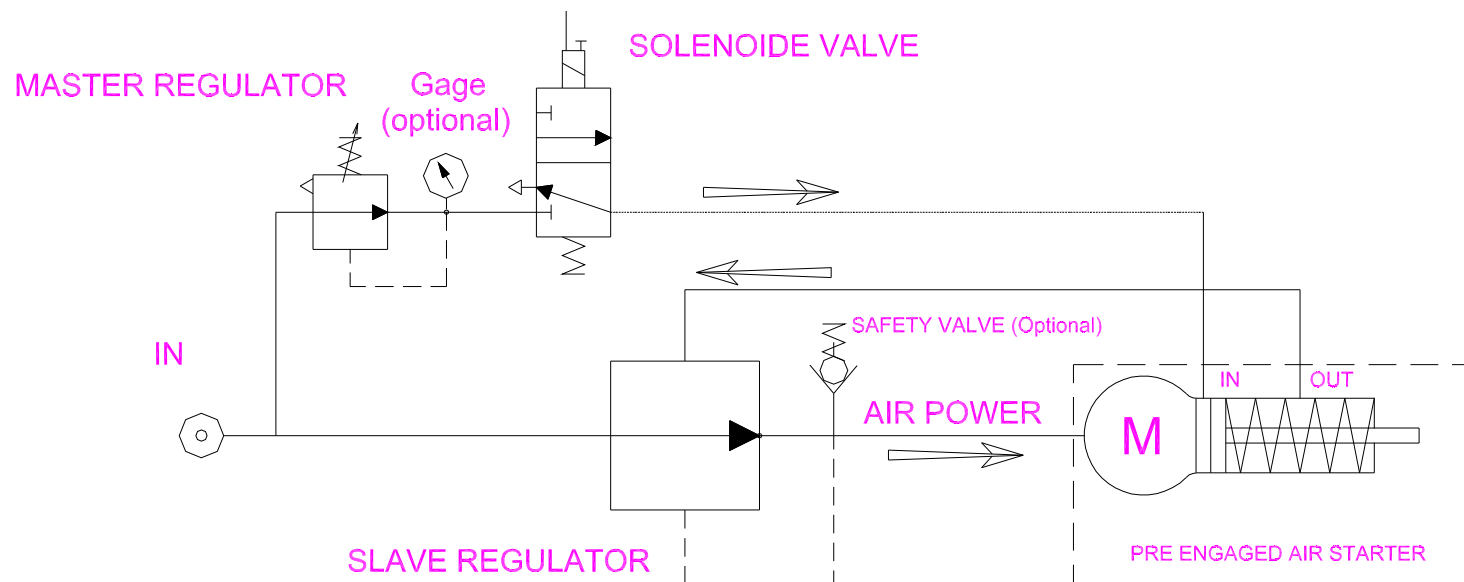
ENGINE STARTING SYSTEMS

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Ingersoll-Rand

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Version : 5C

4.2 For Pre-engaged drive Applications:



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Ingersoll-Rand

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Version : 5C

4. Specifications :**5.1 Master Regulator :**

Specifications		
Flow Capacity*	/	l/s
Maximum Operating Temperature	°C (°F)	
Maximum Supply Pressure	bars (psig)	
Adjusting Range Pressure	- , bars (psig)	
Port Size	BSP	/
Gauge Port(s)	BSPT	() /
Weight	kg (lb)	, (,)

* Inlet Pressure 7 bars (100 psig). Secondary pressure 5.5 bars (80 psig)

5.2 Slave Regulator :

Specifications		
Flow Capacity *	1 1/2	855 l/s (1800 scfm)
Maximum Operating Temperature	79°C (175°F)	
Maximum Supply Pressure	35 bars (500 psig)	
Adjusting Range Pressure	0 - 11 bars (160 psig)	
Port Size	BSP	¼ & 1/2
Gauge Port (s)	BSPT	(2) 1/4
Weight	kg (lb)	6 (14,4)

* Inlet Pressure 7 bars (100 psig). Secondary pressure 5.5 bars (80 psig)

5. Materials of construction :

6.1 Master Regulator

Materials of Construction	
Body	Brass
Bonnet	Brass
Diaphragm	Nitrile/Brass
Valve Assembly	Brass/Nitrile
Springs	Stainless Steel
Seals	Nitrile

6.2 Slave Regulator :

Materials of Construction	
Body	Brass
Bonnet	Brass
Piston	Brass
Valve Assembly	Brass/Nitrile/Acetal
Springs	Stainless Steel
Seals	Nitrile

8. Installation - Maintenance and Recommendations:

- ? **Always wear eyes protection when performing any maintenance on this valve.**
- ? **Always turn off the air and electrical supply and disconnect the air and electrical supply before installing or removing any component on this valve, before making any adjustments on this valve or before performing any maintenance on this valve.**
- ? **Never attempt to remove the cap and/or the housing cover until air pressure has been bleed of. If this is done while there is pressure in the piping, internal parts of the valve will be blown out with considerable force.**
- ? **This Starter Relay Valve is specially designed and manufactured by Ingersoll Rand for use on Starter installations. Install it in accordance with the following instructions.**
- ? **Rated operating conditions :**
 - Inlet pressure : 15 to 450 PSIG (1 to 30 bar)
 - Outlet pressure : 0 to 145 PSIG (0 to 10 bar)
 - Temperature : -20 to 80° C. (- 77.6 to 137.6° F) With dewpoint less than air temperature below 0° C.
 - Fluid : Air compressed
 - Filtration : 50µ (300 mesh)
 - Max flow : 1250 NI/s
 - 24 VDC solenoid valve
 - Weight : 6.5 Kg
 - In/Outlet port : SAE 1"1/2
- ? **Note :**
 - This valve normally design to be actuated with its 3ways solenoid pilot valve but it can be actuated directly with the manual control valve SMB-618.**
 - This valve can be used either for inertia drive or pre-engaged Starter.**
 - Its own master pressure regulator control the air pressure on the outlet port of the slave valve.**

INSTALLATION

1. Place the valve on the air inlet of the starter.

If the starter air inlet have a flange seat, type j518c, place the valve directly on the starter and use a 1"1/2 hose with the flange kit ST700-K166 for connection to the receiver. Four Bolts (RR150-B165) will be necessary when installing the RR150-F30 valve directly on the Starter.

On all Threaded connections throughout the system, use Ingersoll-Rand N° SMB-441 sealant or Loctite Pipe Sealant. After all connections have been made, check each joint with soap bubble test. There must be no leaks in live air lines

2. Make certain the connection is made to the inlet of the relay valve indicated by the word "IN".
3. For pre engaged air starter, install an air hose 4/6 mm from the air outlet of the pilot solenoid valve to the "IN" port on the starter Drive Housing. Install a 4/6 mm hose line from the "OUT" port on the Starter Drive Housing to the 1/4" port on top of the Relay Valve See p3.
4. For Inertia starter Install a 4/6 mm hose line from the outlet port of the pilot solenoid valve to the 1/4" port on top of the RR150-F30 valve. See p3. .

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Ingersoll-Rand

Created : 10/16/98
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Version : 5C

DISASSEMBLY

? GENERAL INFORMATION :

1. Do not disassemble the valve any further than necessary to replace worn or damaged parts.
2. When grasping a part in a vice jaw, always use copper -covered vies jaws to protect the surface of the part and help prevent distortion. This is particularly true of threaded 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 on hand before starting any overhaul of a valve. Never reuse old seals or gaskets.

? DISASSEMBLY OF THE SLAVE VALVE :

- 1 . Using an 5 mm hex-head wrench, unscrew and remove the cap screws (13 or 11). Pull the cap (1) from the valve housing. Pull the return spring and the piston assembly (16 or 15) from the valve housing.
2. Return the valve housing upside down.
3. Using an 6 mm hex-head wrench unscrew and remove the cover screws(14 or 12) . Pull the housing cover (5) from the valve housing. Grasp and pull the master piston (4) from the valve housing.
4. Remove all the O'ring and gasket to be replace.

ASSEMBLY

? GENERAL INSTRUCTIONS :

1. Whenever grasping a valve or part in a vice. Always use copper-covered vice jaws. Take extra care with threaded parts or housings.
2. Except for bearing , always clean every part and wipe every part with a thin film of oil before installation.
3. Apply a film of o-rings lubricant to all o-rings before final assembly.

? ASSEMBLY OF THE VALVE :

1. Place the gasket (8 or 7) in the grommet (3).
2. Lubricate the piston shaft with O-ring lubricant. Slide the piston assembly in the valve housing Slide the piston spring bottom of the piston.
3. Lubricate the o-ring (7 or 6) in the groove of the valve housing.
4. Install the cap (1) in the valve housing. Install the cap cover screw (13 or 11) and using a 5 mm hex wrench tighten it to 25 Nm .
5. Return the valve housing in the vice and grasp it.
6. Install the o-ring(11) in the piston groove , lubricate it with an o-ring lubricant, slide the piston in the valve housing.

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7. Lubricate the o-ring (9) and install it in the valve housing groove.
8. Install the housing cover (5) in the valve housing. Install the cover screws (14 or 12) and using a 5mm hex wrench tighten it to 25 Nm .

? DISASSEMBLY / ASSEMBLY OF THE MASTER PRESSURE REGULATOR

1-The pressure regulator can be disassembled without removal from the Slave Valve.

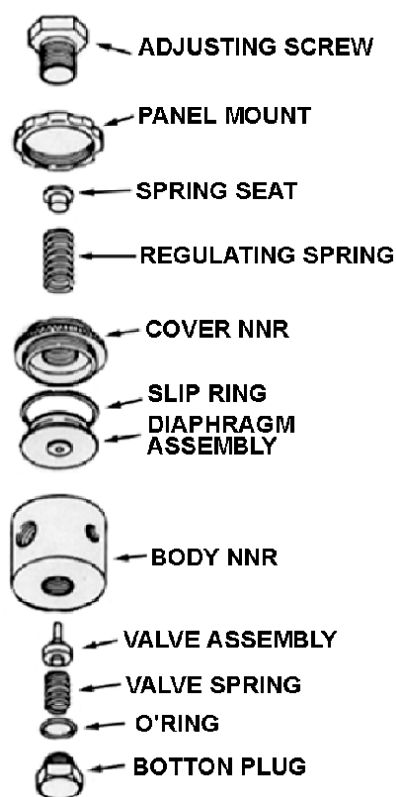
2-To disassemble –shut off air to the system and vent line on both sides of regulator. Turn adjusting screw counterclockwise to relieve compression of the spring, and cover. Diaphragm assembly can now be removed .By removing bottom plug, valve spring and valve assembly can be removed.

CAUTION: When assembling ,tighten cover to 9 Nm and bottom plug to 1 Nm . Relubricate O-Ring with O-Ring Lube.

3-Occasionally disassemble and clean body and valve seat.

4-If the regulator will not regulate to desired pressure or if pressure become excessive-disassemble, clean and check O-Ring, valve stem, valve seat for wear or damage. Replace worn or damaged parts

5- If regulator leaks at relief port, install proper repair kit regarding RR150 valve model.



This pressure regulator is design in order to regulate pressure from 30 bar to 10 bars All components are design and tested In order to meetCGAE-7.

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NOTICE

The use of other than genuine INGERSOLL-RAND replacement parts may result in safety hazards, decreased starter relay valve performance and increased maintenance, and may invalidate all warranties.

Ingersoll Rand is not responsible for customer modification of valve for applications on which Ingersoll Rand was not consulted.

Repairs should be made only by authorised, trained personnel. Consult your nearest Ingersoll Rand Authorised Service center.

It is the responsibility of the employer to place the information in this manual into the hands of the operator.

WARNING

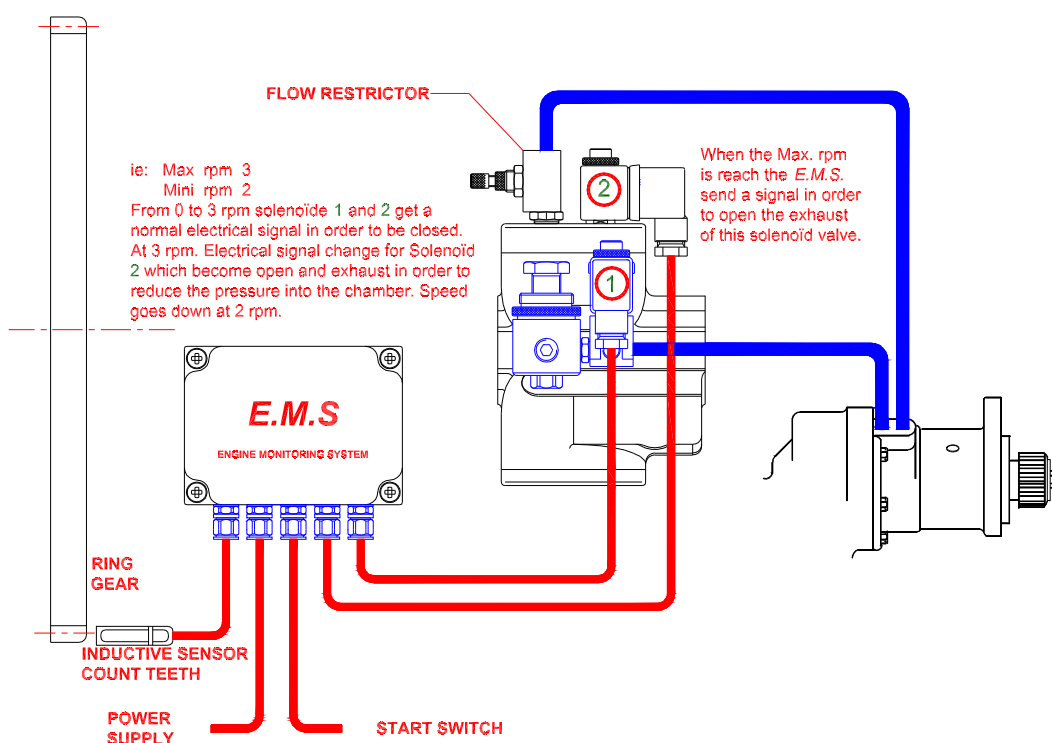
Always wear eye protection when installing, removing or performing maintenance on this starter relay valve.

9. Slow cranking device

Slow cranking before to start the engine is an issue becoming more popular, in order to achieve this job the RR150-F30 has been design in order to give this possibility .On the cover (5) a flow restrictor and a calibrated solenoid valve are install. The flow restrictor control the air compressed flow in order to get an accurate and soft opening action of the valve ,The calibrated solenoid valve is normaly open and has a calibrated exhaust .

When the switch button is actuated (in order to start the engine),The solenoid valve « 1 » and « 2 » are open (for the « 1 » and closed for « 2 ») signal goes to the pilot « IN » port of the drive housing, push forward the pinion in order to mesh the ring gear, after engagement the signal is coming from the « OUT » port of the drive housing to the flow restrictor. The flow restrictor control the amount of air compressed going to the Piston (4) of the RR150-F30 the piston is sliding down open progressively the valve and power the starter motor.

As soon the ring start to rotate the engine management system get information through the sensor (magnetic pick up).When the engine reach the desired speed the EMS send a signal to solenoid valve « 2 » which open and reduce the pressure in the top of the RR150-F30.This drop of pressure will reduce the flow and the pressure in the starter motor the torque will be just able to keep the engine rotating slowly (just able to pass the compression).When the engine has done the amount of revolutions set up in the EMS the solenoid valve is Kept Closed and starter motor can get the maximum power ,and will crank the engine up to ignition.



The EMS is the computer monitoring the engine .

Ingersoll-Rand supply is just the Starter, The RR150-F30 fitted with the extra solenoid valve

ENGINE STARTING SYSTEMS

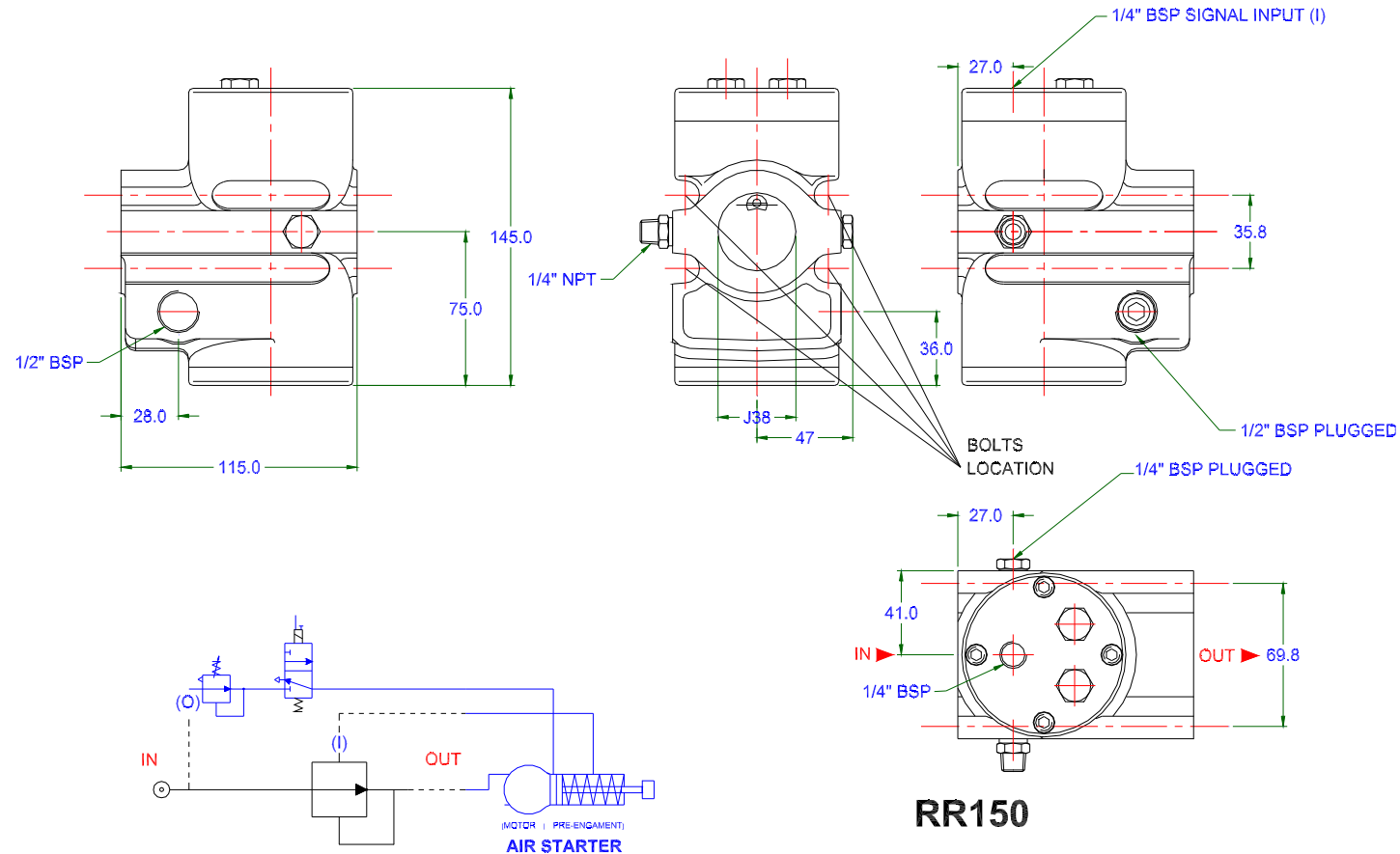
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10. Dimensional drawing and part list:

10.1 RR150



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Ingersoll-Rand

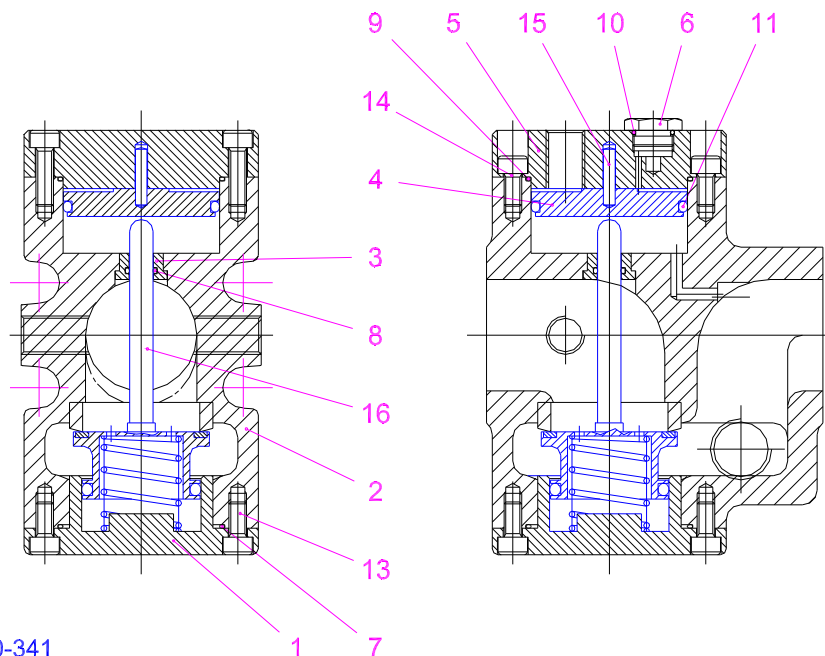
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Version : 5C

Rep Description Part number

- 1 CAP RR150-616A
- 2 HOUSING RR150-A40
- 3 GROMMET RR150-618
- 4 MASTER PISTON RR150-1
- 5 HOUSING COVER RR150-338
- 6 COVER PLUG (2) RR150-368
- 7 GASKET include in valve tune up kit RR150-337
- 8 O-RING include in valve tune up kit RR150-339
- 9 O-RING include in valve tune up kit RR150-340
- 10 COVER PLUG GASKET RR150-52
- 11 MASTER PISTON O-RING include in valve tune up kit RR150-341

- 13 CAP SCREW (4) RR150-157
- 14 COVER SCREW (4) RR150-157
- 15 MASTER PISTON PIN include with item 4 RR150-343
- 16 PISTON ASSEMBLY (INCLUDE RETURN SPRING) RR150-K618V

VALVE TUNE UP KIT RR150-TK1 (7;8;9;11;16)



RR150

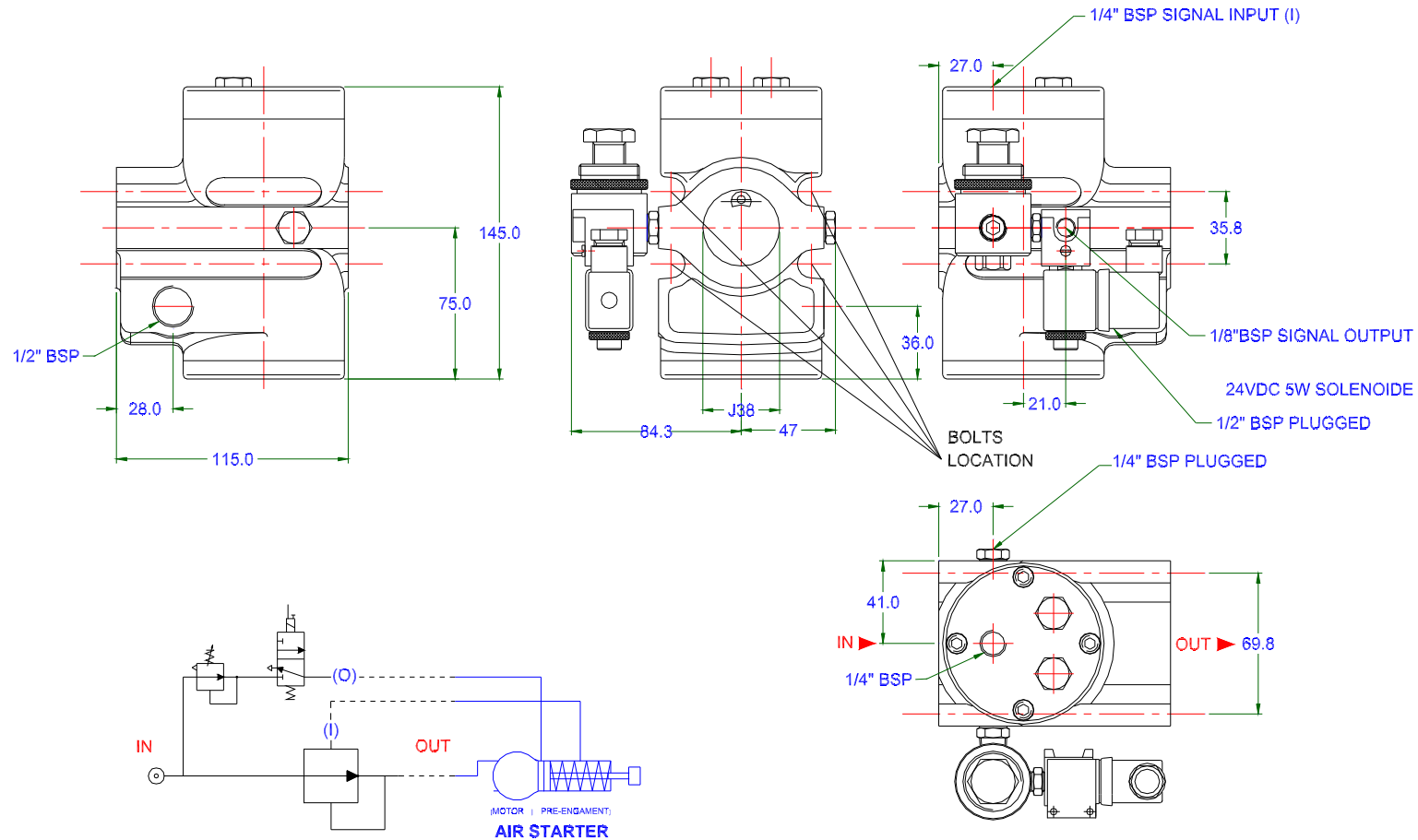
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10.2 RR150-F30



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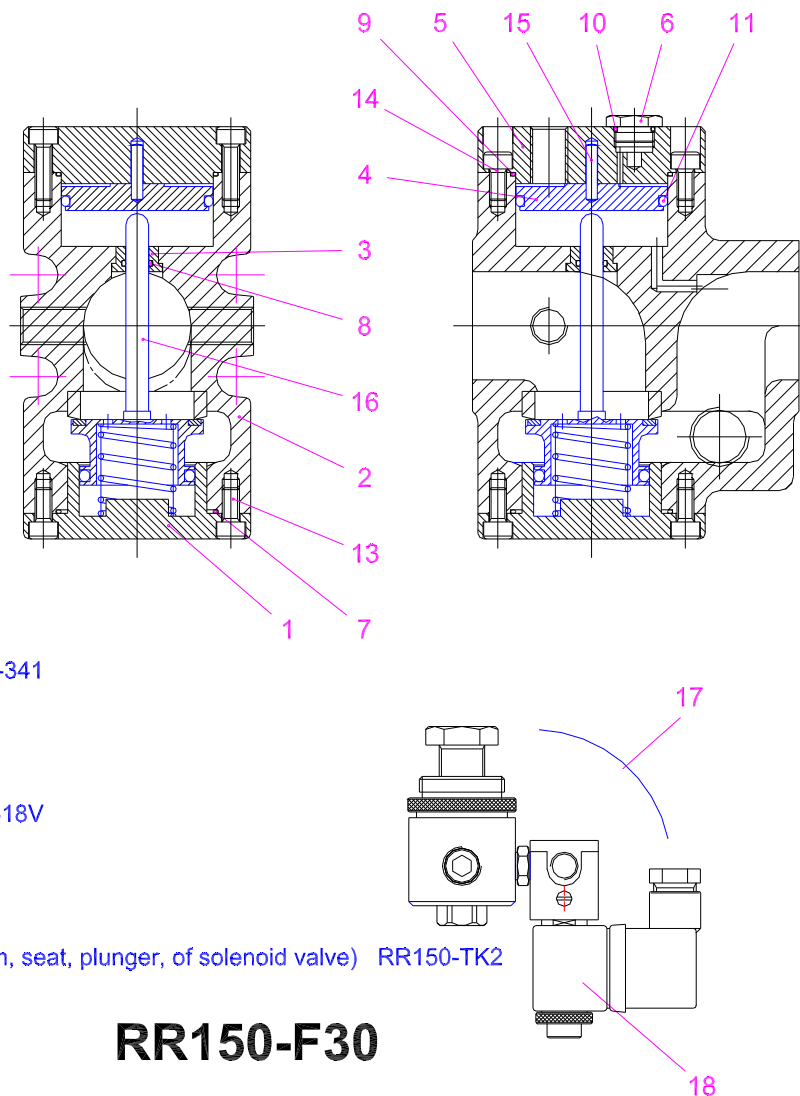
Rep Description Part number

- 1 CAP RR150-616A
- 2 HOUSING RR150-A40
- 3 GROMMET RR150-618
- 4 MASTER PISTON RR150-1
- 5 HOUSING COVER RR150-338
- 6 COVER PLUG (2) RR150-368
- 7 GASKET include in valve tune up kit RR150-337
- 8 O-RING include in valve tune up kit RR150-339
- 9 O-RING include in valve tune up kit RR150-340
- 10 COVER PLUG GASKET RR150-52
- 11 MASTER PISTON O-RING include in valve tune up kit RR150-341

- 13 CAP SCREW (4) RR150-157
- 14 COVER SCREW (4) RR150-157
- 15 MASTER PISTON PIN include with item 4 RR150-343
- 16 PISTON ASSEMBLY (INCLUDE RETURN SPRING) RR150-K618V
- 17 PILOT REGULATOR INCLUDE SOLENOIDE ST400-2450-5S
- 18 SOLENOIDE VALVE RR100-2450-5S

VALVE TUNE UP KIT RR150-TK1 (7;8;9;11;16)

PILOT REGULATOR TUNE UP KIT (include pilot regulator diaphragm, seat, plunger, of solenoid valve) RR150-TK2



Document : Technical Documentation
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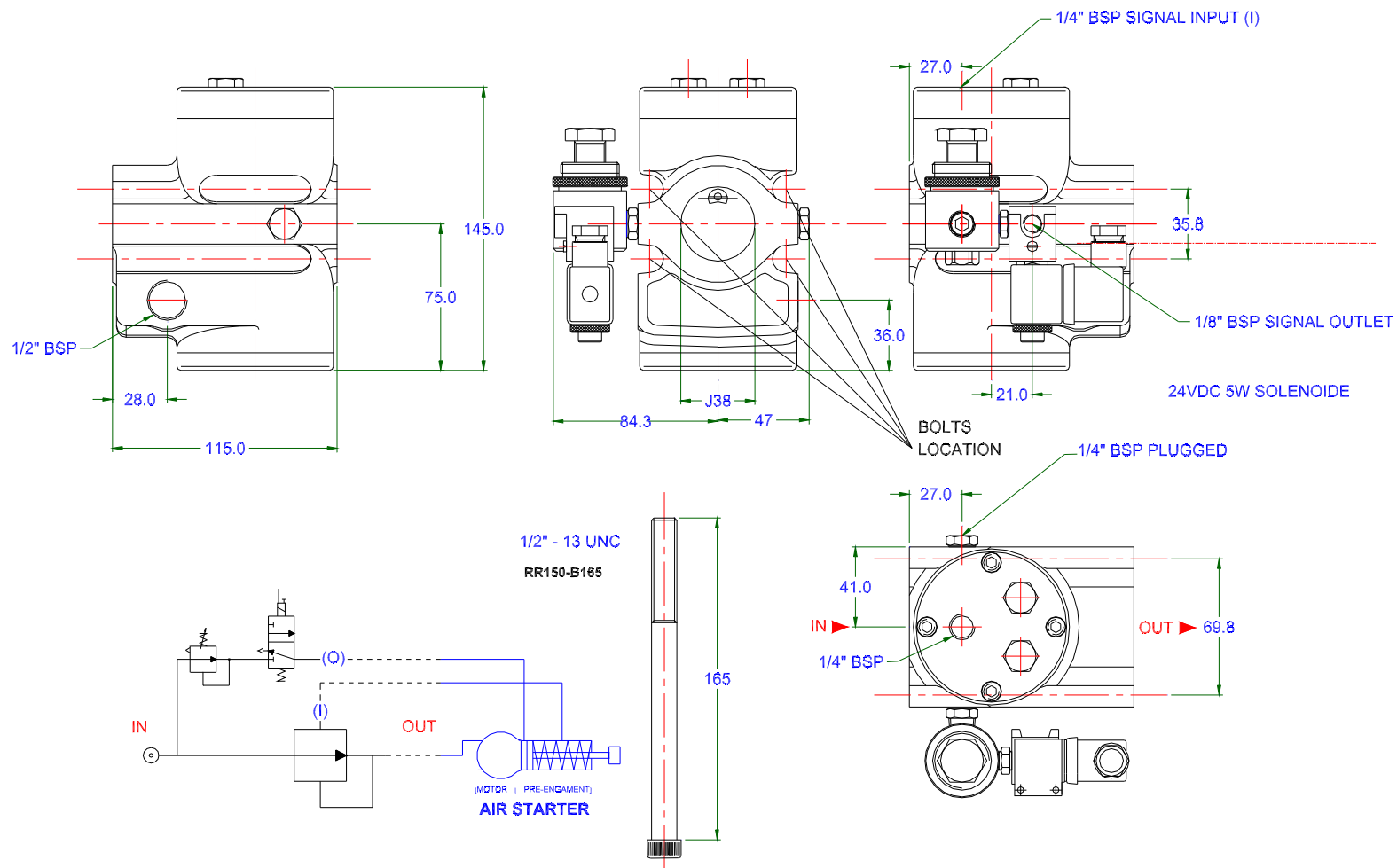
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Version : 5C

10.3 RR150-F30-B



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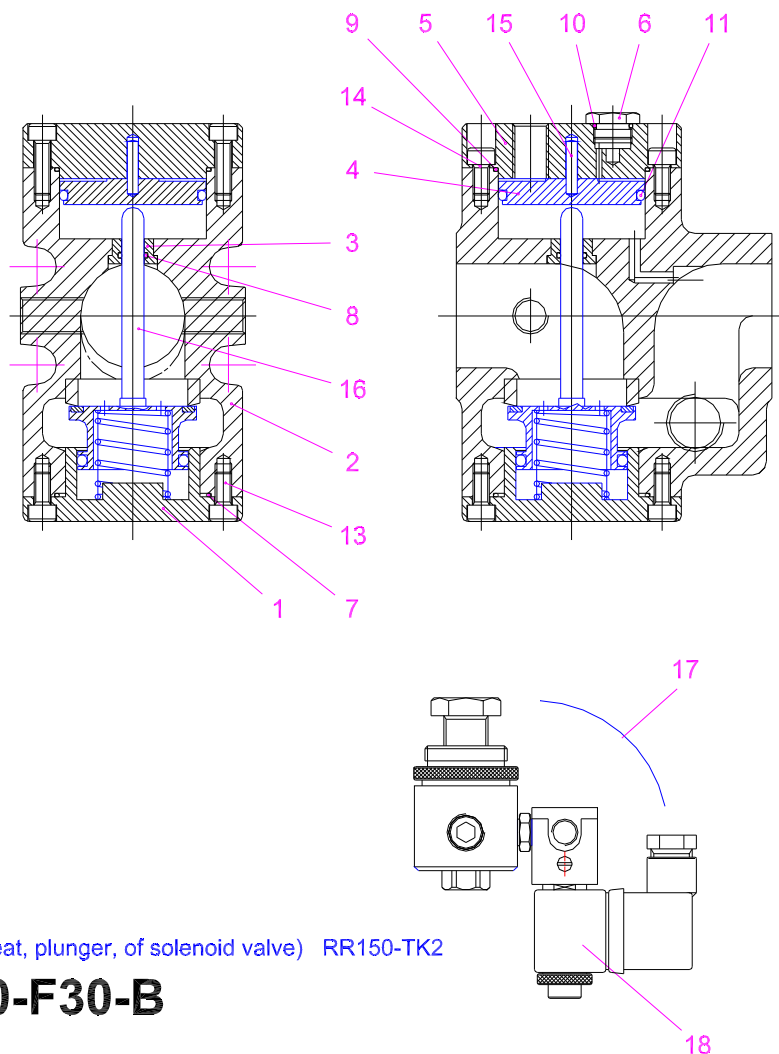
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- 15 MASTER PISTON PIN include with item 4 RR150-343
- 16 PISTON ASSEMBLY (INCLUDE RETURN SPRING) RR150-K618V
- 17 PILOT REGULATOR INCLUDE SOLENOID ST400-2450-5S
- 18 SOLENOID VALVE RR100-2450-5S

VALVE TUNE UP KIT RR150-TK1 (7;8;9;11;16)

PILOT REGULATOR TUNE UP KIT (include pilot regulator diaphragm, seat, plunger, of solenoid valve) RR150-TK2

RR150-F30-B



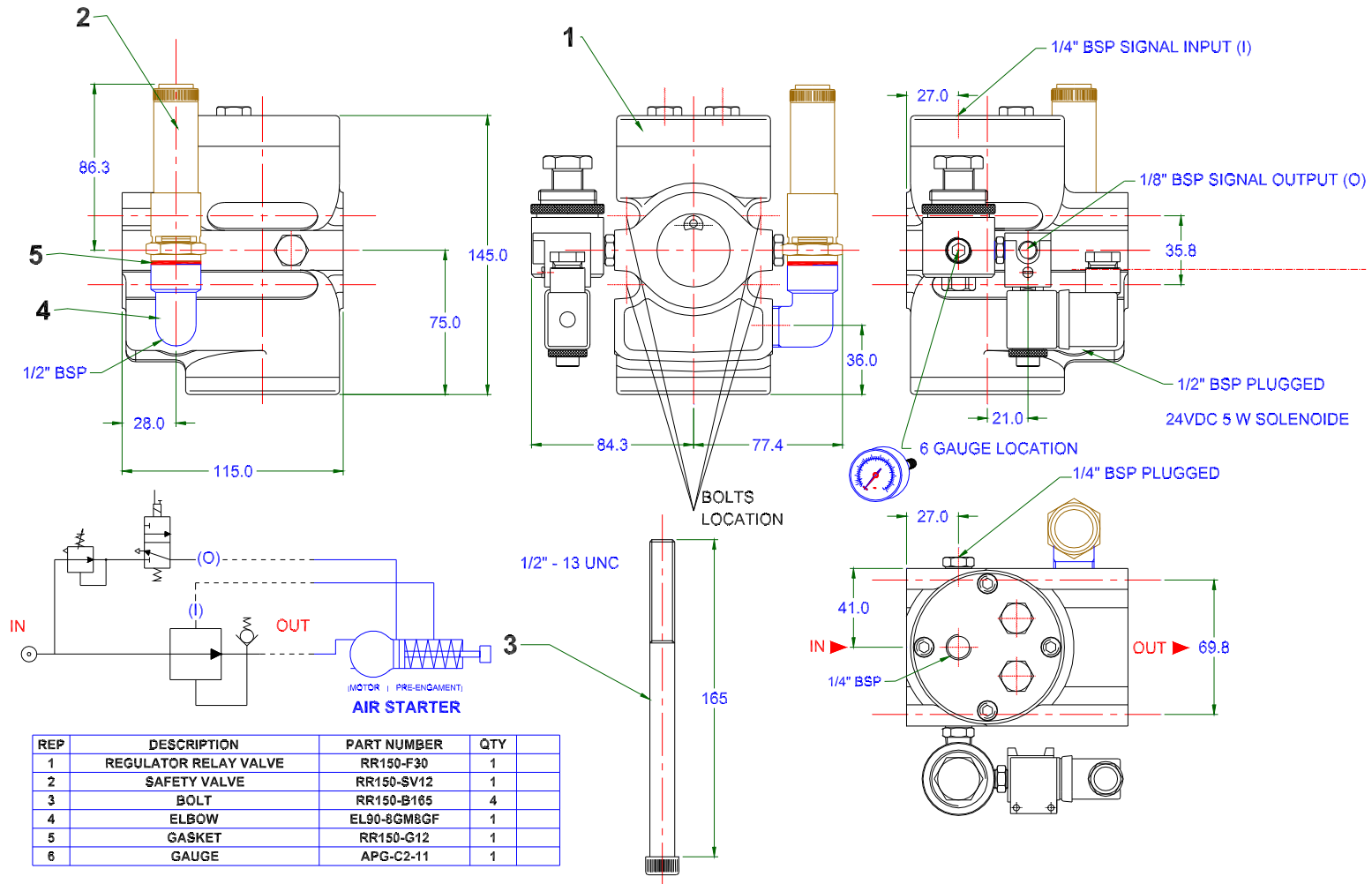
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10.3 RR150-F30-D



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- 13 CAP SCREW (4) RR150-157
- 14 COVER SCREW (4) RR150-157
- 15 MASTER PISTON PIN include with item 4 RR150-343
- 16 PISTON ASSEMBLY (INCLUDE RETURN SPRING) RR150-K618
- 17 PILOT REGULATOR INCLUDE SOLENOIDE ST400-2450-5S
- 18 SOLENOIDE VALVE RR100-2450-5S

VALVE TUNE UP KIT RR150-TK1 (7;8;9;11;16)

PILOT REGULATOR TUNE UP KIT (include pilot regulator diaphragm, seat, plunger, of solenoid valve) RR150-TK2

RR150-F30-D

