Installation, Operation and Maintenance Manual
VA-DC-000-1931 Rev. 0
January 2021

Bettis G-Series

Acculine Drive Shaft Replacement

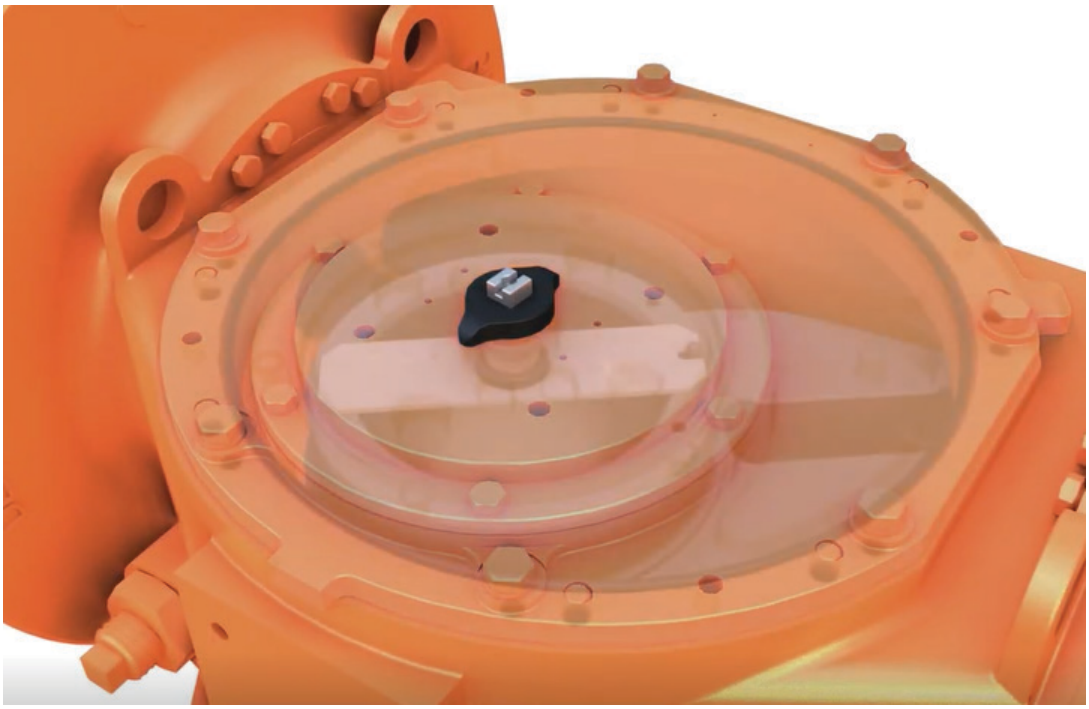

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Table of Contents

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Section 1: Introduction

1.1 General Service Information

1.1.1 This service procedure is offered as a guide to enable Bettis™ Acculine drive shaft replacement to be performed on Bettis™ G01 - G13 G-Series Actuators.

1.1.2 This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator.

1.1.3 Remove all piping and mounted accessories that will interfere with the module(s) that are to be worked on.

1.1.4 This procedure should only be implemented by a technically competent technician who should take care to observe good workmanship practices.

1.1.5 Numbers in parentheses, ( ) indicate the bubble number (reference number) used on the Bettis assembly drawing and Actuator Parts List.

1.1.6 This procedure is written using the stop screw side of the housing (1 - 10) as a reference and this side will be considered the front side of the actuator. The housing cover (1 - 20) will be the top of the actuator.

1.1.7 When removing seals from seal grooves, use a commercial seal removing tool or a small screwdriver with sharp corners rounded off.

1.1.8 Use a non-hardening thread sealant on all pipe threads.

⚠ CAUTION

Apply the thread sealant per the manufacturer's instructions.

1.1.9 Bettis recommends that disassembly of the actuator components should be done in a clean area on a workbench.

1.2 Definitions

⚠ WARNING

If not observed, user incurs a high risk of severe damage to actuator and/or fatal injury to personnel.

⚠ CAUTION

If not observed, user may incur damage to actuator and/or injury to personnel.

NOTE:

Advisory and information comments provided to assist maintenance personnel to carry out maintenance procedures.

1.3 General Safety Information

Products supplied by Bettis, in its “as shipped” condition, are intrinsically safe if the instructions contained within this Service Instruction are strictly adhered to and executed by well trained, equipped, prepared and competent personnel.

⚠ WARNING

For the protection of personnel working on Bettis actuators, this procedure should be reviewed and implemented for safe disassembly and reassembly. Close attention should be noted to the WARNINGS, CAUTIONS and NOTES contained in this procedure.

⚠ WARNING

This procedure should not supersede or replace any customer’s plant safety or work procedures. If a conflict arises between this procedure and the customer’s procedures the differences should be resolved in writing between an authorized customer's representative and an authorized Bettis representative.

1.4 Service Support Items

1.4.1 Bettis module service kits.

1.4.2 Commercial leak testing solution.

1.4.3 Non-hardening thread sealant.

1.5 Lubrication and Fluid Requirements

NOTE:

Lubricants and hydraulic fluids other than those listed in steps 1.5.1 and 1.5.2 should not be used without prior written approval of Bettis Product Engineering.

1.5.1 Lubricants:

All temperature services (-20 °F to +350 °F) / (-29 °C to 176 °C) use Bettis ESL-5 lubricant. ESL-5 lubricant is contained in the Bettis module service kit in tubes or cans and they are marked ESL-5 and 10 lubricant. For low temperature service (-40 °F to 150 °F) / (-40 °C to 65.6 °C) use ESL 15 lubricant. ESL 15 lubricant is contained in low temperature Bettis module service kits in tubes or cans and they are marked ESL 15 lubricant.

1.5.2 Fluids:

M18 Manual Hydraulic Override System – Standard and high temperature service (-20 °F to +350 °F) / (-28.9 °C to 176.6 °C) use Shell Tellus T-32 Automatic Transmission Fluid. Low temperature service (-40 °F to 150 °F) / (-40 °C to 65.6 °C) use Univis J13 or HVI 13 Hydraulic Fluid.

1.6 General Tool Information

1.6.1 Tools:

All tools/Hexagons are American Standard inch. Large adjustable wrench, two (2) large screwdrivers, Allen wrench set, set of open/box end wrenches, rubber or leather mallet, torque wrench (up to 1200 lbf-ft / 1627 Nm), breaker bar, small drift punch and a drive socket set. For recommended tool and wrench sizes refer to Section 3, Tables 1 through 8.

Section 2: Removal and Installation

2.1 Acculine Drive Shaft Removal

⚠ WARNING

It is possible, that the actuator may contain a dangerous gas and/or liquids. Ensure that all proper measures have been taken to prevent exposure or release of these types of contaminants before commencing any work.

⚠ WARNING

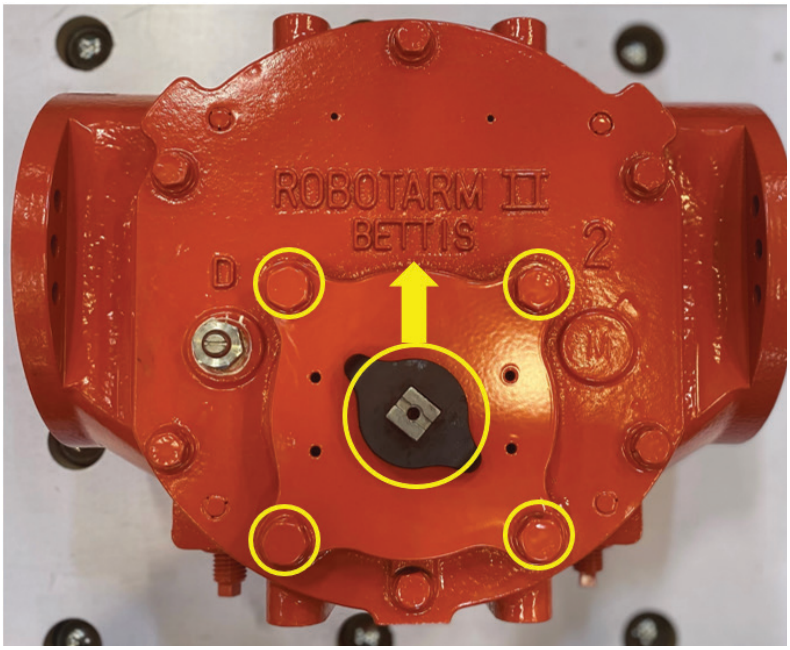
If not already removed disconnect all operating pressure from actuator power cylinders.

⚠ WARNING

The spring cartridge must be checked to verify that the spring(s) are in their extended position before the spring cartridge is removed from the actuator.

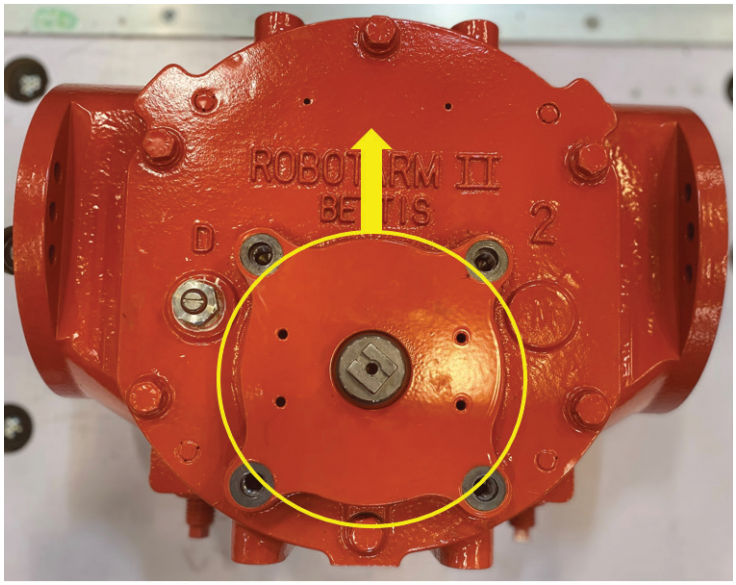
2.1.1 Remove the plastic position indicator (1 - 220), unscrew Hex head screws (1 - 160) and remove the screws (1 - 160) and washers (1 - 170) from actuators. Refer to Section 3 for screw size.

Figure 1



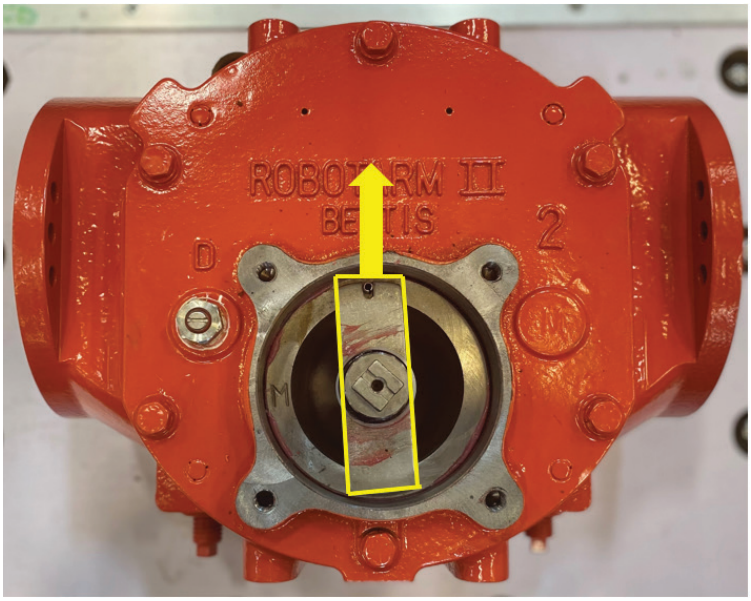
2.1.2 Remove the yoke cover (1 - 150) from the actuator.

Figure 2



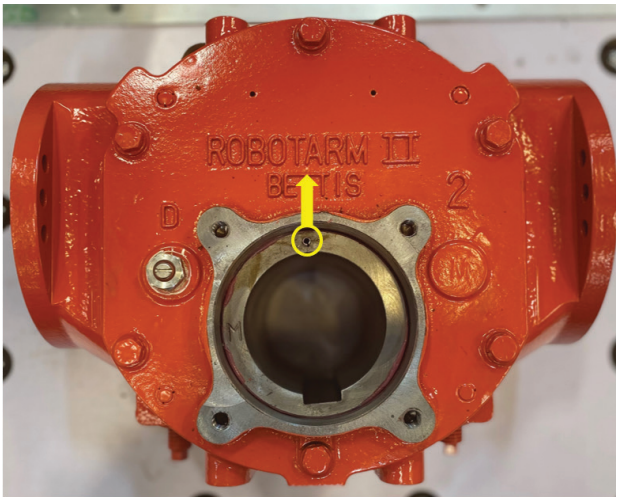
2.1.3 Remove the position indicator assembly (1 - 140) from the actuator.

Figure 3



2.1.4 Use proper tools to remove the spring pin (1 - 100) from the actuator.

Figure 4



2.2 New Acculine Drive Shaft Installation

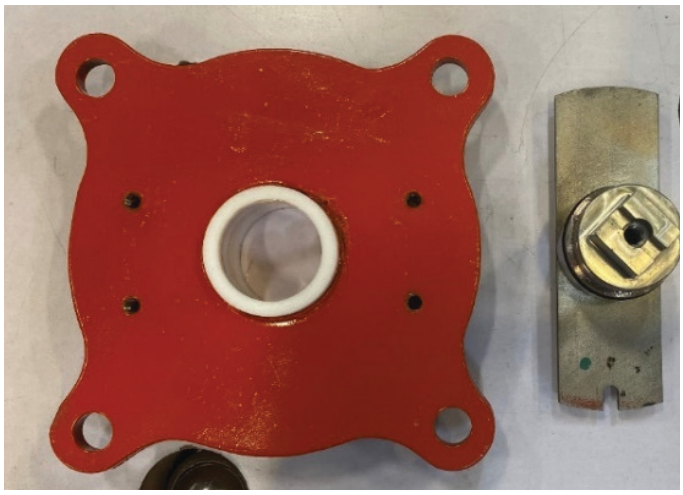
NOTE:
Properly clean the surfaces before installation to ensure better actuator performance.

2.2.1 Insert the new spring pin (1 - 100) into the yoke, spring pin is provided in the service kit.

Figure 5

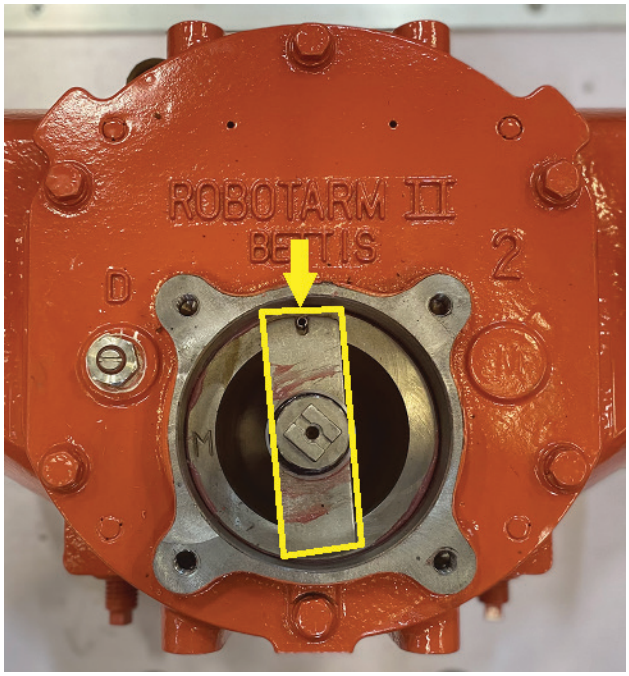
2.2.2 Pull the new position indicator assembly (1 - 140) out from the new yoke cover (1 - 150).

Figure 6



2.2.3 Place the new position indicator assembly (1 - 140) onto the yoke (1 - 70), make sure the spring pin (1 - 100) is in the slot of the position indicator assembly (1 - 140) plate.

Figure 7

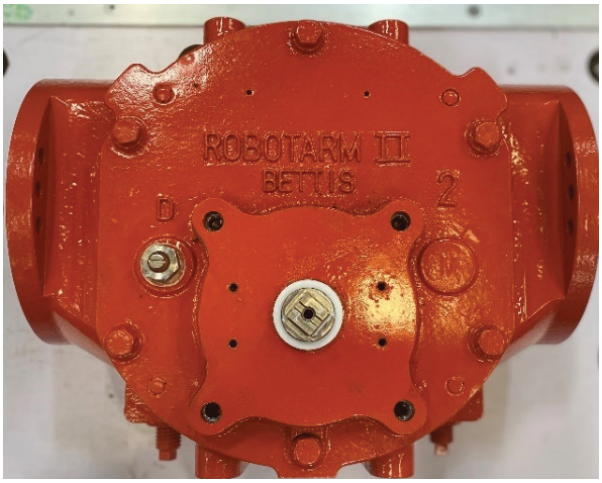


⚠ CAUTION

Pay attention to the O-ring seals in steps 2.2.4 and 2.2.5.

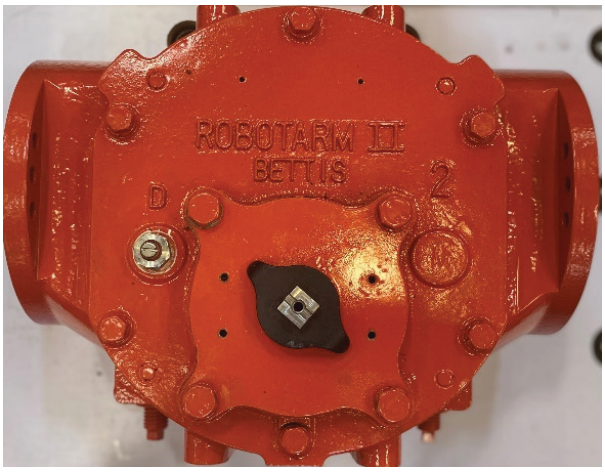
2.2.4 Install new yoke cover assembly (1 - 150) to the housing cover (1 - 20).

Figure 8



2.2.5 Install and tighten the new Hex head screws (1 - 160) and washers (1 - 170). Install new position indicator (1 - 220).

Figure 9



2.2.6 Paint the actuator/module or apply paint touch up on exposed surfaces to create paint protection.

2.2.7 Install the top works (if applicable) back to the actuator.

Section 3: Actuator Support Information

3.1 G01 Tool Style and Wrench Size

Table 1. G01 Tool Style and Wrench Size

Item No.	Wrench Size	Item Qty.	Location or Description	Recommended Tool Style
1 - 110	9/16”	4	Hex Cap Screws	Socket
1 - 160	1/2”	4	Hex Cap Screws	Socket
1 - 180	3/8” sq.	2	Stop Screws	Open End or Adjustable
1 - 190	1 - 15/16”	2	Hex Jam Nuts	Open End or Adjustable
3 - 20	3/8”	2	Tie Bar (flats)	Open End or Adjustable
3 - 40	3/8” sq.	1	Piston Rod	Male Drive
3 - 90	1 - 1/8”	2	Standard Hex Nuts	Socket
3 - 100	9/16”	4	Hex Cap Screws	Socket
3 - 120	5/8” sq.	1	Pipe Plug	Open End or Adjustable
3 - 130	3/16”	2	Socket Cap Screws	Allen
5 - 20	9/16”	4	Hex Cap Screws	Socket
7 - 80	9/16”	4	Hex Cap Screws	Socket
7 - 110	1/8” sq.	1	Square Head Pipe Plug	Open End or Adjustable
7 - 120	9/16” sq.	1	Square Head Pipe Plug	Square Head Pipe Plug
12	1”	1	Breather Assembly	Socket
13	3/4”	2	Vent Check Assembly	Open End
-	3/8” sq.	1	Tension Rod	Male Drive

3.2 G2 Tool Style and Wrench Size

Table 2. G2 Tool Style and Wrench Size

Item No.	Wrench Size	Item Qty.	Location or Description	Recommended Tool Style
1 - 110	9/16”	6	Hex Cap Screws	Socket
1 - 160	9/16”	4	Hex Cap Screws	Socket
1 - 180	3/8” sq.	2	Stop Screws	Open End or Adjustable
1 - 190	1 - 1/8”	2	Hex Jam Nuts	Open End or Adjustable
3 - 20	3/8”	2	Tie Bar (flats)	Open End or Adjustable
3 - 40	3/8” sq.	1	Piston Rod	Male Drive
3 - 90	1 - 1/8”	4	Standard Hex Nuts	Socket
3 - 100	9/16”	4	Hex Cap Screws	Socket
3 - 120	5/8” sq.	1	Pipe Plug	Open End or Adjustable
3 - 130	3/16”	2	Socket Cap Screws	Allen
5 - 20	9/16”	6	Hex Cap Screws	Socket
7 - 80	9/16”	4	Hex Cap Screws	Socket
7 - 110	1/8” sq.	1	Square Head Pipe Plug	Open End or Adjustable
7 - 120	1/2” sq.	1	Square Head Pipe Plug	Open End or Adjustable
12	1”	1	Breather Assembly	Open End
13	3/4”	2	Vent Check Assembly	Open End
-	3/8” sq.	1	Tension Rod	Male Drive

3.3 G3 Tool Style and Wrench Size

Table 3. G3 Tool Style and Wrench Size

Item No.	Wrench Size	Item Qty.	Location or Description	Recommended Tool Style
1 - 110	9/16”	8	Hex Cap Screws	Socket
1 - 160	9/16”	4	Hex Cap Screws	Socket
1 - 180	1/2” sq.	2	Stop Screws	Open End or Adjustable
1 - 190	1 - 5/16”	2	Hex Jam Nuts	Open End or Adjustable
3 - 20	1/2”	2	Tie Bar (flats)	Open End or Adjustable
3 - 40	3/8” sq.	1	Piston Rod	Male Drive
3 - 90	1 - 5/16”	4	Standard Hex Nuts	Socket
3 - 100	9/16”	6	Hex Cap Screws	Socket
3 - 120	5/8” sq.	1	Pipe Plug	Open End or Adjustable
3 - 130	3/16”	2	Socket Cap Screws	Allen
5 - 20	9/16”	6	Hex Cap Screws	Socket
7 - 80	9/16”	6	Hex Cap Screws	Socket
7 - 110	1/8” sq.	1	Square Head Pipe Plug	Open End or Adjustable
7 - 120	1/2” sq.	1	Square Head Pipe Plug	Open End or Adjustable
12	1”	1	Breather Assembly	Open End
13	3/4”	2	Vent Check Assembly	Open End
-	3/8” sq.	1	Tension Rod	Male Drive

3.4 G4 Tool Style and Wrench Size

Table 4. G4 Tool Style and Wrench Size

Item No.	Wrench Size	Item Qty.	Location or Description	Recommended Tool Style
1 - 110	9/16”	8	Hex Cap Screws	Socket
1 - 160	9/16”	4	Hex Cap Screws	Socket
1 - 180	3/4” sq.	2	Stop Screws	Open End or Adjustable
1 - 190	1 - 13/16”	2	Hex Jam Nuts	Open End or Adjustable
3 - 20	5/8”	2	Tie Bar (flats)	Open End or Adjustable
3 - 40	1/2” sq.	1	Piston Rod	Male Drive
3- 90	1 - 5/8”	2	Standard Hex Nuts	Socket
3 - 100	3/4”	6	Hex Cap Screws	Socket
3 - 120	5/8” sq.	1	Pipe Plug	Open End or Adjustable
3 - 130	3/16”	2	Socket Cap Screws	Allen
5 - 20	3/4”	6	Hex Cap Screws	Socket
7 - 80	3/4”	6	Hex Cap Screws	Socket
7 - 110	1/8” sq.	1	Square Head Pipe Plug	Open End or Adjustable
7 - 120	1/2” sq.	1	Square Head Pipe Plug	Open End or Adjustable
12	1”	1	Breather Assembly	Open End
13	3/4”	2	Vent Check Assembly	Open End
-	3/4”	1	Tension Rod	Male Drive

3.5 G5 Tool Style and Wrench Size

Table 5. G5 Tool Style and Wrench Size

Item No.	Wrench Size	Item Qty.	Location or Description	Recommended Tool Style
1 - 110	3/4”	8	Hex Cap Screws	Socket
1 - 120	3/4”	4	Hex Cap Screws	Socket
1 - 160	9/16”	6	Hex Cap Screws	Socket
1 - 180	7/8” sq.	2	Stop Screws	Open End or Adjustable
1 - 190	2 - 3/8”	2	Heavy Hex Jam Nuts	Open End or Adjustable
3 - 20	1/2” sq.	2	Tie Bar (flats)	Open End or Adjustable
3 - 40	1/2” sq.	1	Piston Rod	Male Drive
3 - 90	2”	2	Standard Hex Nuts	Socket
3 - 100	3/4”	8	Hex Cap Screws	Socket
3 - 120	1 - 1/8” sq.	1	Pipe Plug	Open End or Adjustable
3 - 130	3/16”	2	Socket Cap Screws	Allen
5 - 20	3/4”	8	Hex Cap Screws	Socket
7 - 80	3/4”	8	Hex Cap Screws	Socket
7 - 110	1/8” sq.	1	Square Head Pipe Plug	Open End or Adjustable
7 - 120	1/2” sq.	1	Square Head Pipe Plug	Open End or Adjustable
12	1”	1	Breather Assembly	Open End
13	3/4”	2	Vent Check Assembly	Open End
-	3/4”	1	Tension Rod	Male Drive

3.6 G7 Tool Style and Wrench Size

Table 6. G7 Tool Style and Wrench Size

Item No.	Wrench Size	Item Qty.	Location or Description	Recommended Tool Style
1 - 110	3/4”	8	Hex Cap Screws	Socket
1 - 120	3/4”	4	Hex Cap Screws	Socket
1 - 160	9/16”	8	Hex Cap Screws	Socket
1 - 180	1”	2	Stop Screws	Open End or Adjustable
3 - 20	3/4” sq.	2	Tie Bar (female square)	Open End or Adjustable
3 - 40	3/4” sq.	1	Piston Rod	Male Drive
3 - 90	2 - 3/8”	2	Standard Hex Nuts	Socket
3 - 100	15/16”	8	Hex Cap Screws	Socket
3 - 120	1 - 1/8” sq.	1	Pipe Plug	Open End or Adjustable
3 - 130	3/16”	2	Socket Cap Screws	Allen
5 - 20	15/16”	8	Hex Cap Screws	Socket
7 - 80	15/16”	8	Hex Cap Screws	Socket
7 - 100	15/16”	8	Hex Cap Screws	Socket
7 - 110	9/16”	1	Flush Socket Head Pipe Plug	Allen
7 - 130	9/32” sq.	1	Square Head Pipe Plug	Open End or Adjustable
12	1”	1	Breather Assembly	Open End
13	3/4”	2	Vent Check Assembly	Open End
-	3/4”	2	Tension Rod	Male Drive

3.7 G8 Tool Style and Wrench Size

Table 7. G8 Tool Style and Wrench Size

Item No.	Wrench Size	Item Qty.	Location or Description	Recommended Tool Style
1 - 110	3/4”	12	Hex Cap Screws	Socket
1 - 120	3/4”	4	Hex Cap Screws	Socket
1 - 160	9/16”	8	Hex Cap Screws	Socket
1 - 180	1 - 1/4”	2	Stop Screws	Open End or Adjustable
3 - 20	3/4” sq.	2	Tie Bar (female square)	Open End or Adjustable
3 - 40	3/4” sq.	1	Piston Rod	Male Drive
3 - 90	2 - 3/4”	2	Heavy Hex Nuts	Socket
3 - 100	1 - 1/8”	8	Hex Cap Screws	Socket
3 - 120	1 - 5/16” sq.	1	Pipe Plug	Open End or Adjustable
3 - 130	3/16”	2	Socket Cap Screws	Allen
5 - 20	1 - 1/8”	8	Hex Cap Screws	Socket
7 - 80	1 - 1/8”	8	Hex Cap Screws	Socket
7 - 100	1 - 1/8”	8	Hex Cap Screws	Socket
7 - 110	9/16”	1	Flush Socket Head Pipe Plug	Allen
7 - 130	9/32” sq.	1	Square Head Pipe Plug	Open End or Adjustable
12	1”	1	Breather Assembly	Open End
13	3/4”	2	Vent Check Assembly	Open End
-	3/4”	1	Tension Rod	Male Drive

3.8 G10 Tool Style and Wrench Size

Table 8. G10 Tool Style and Wrench Size

Item No.	Wrench Size	Item Qty.	Location or Description	Recommended Tool Style
1 - 110	3/4”	16	Hex Cap Screws	Socket
1 - 120	3/4”	4	Hex Cap Screws	Socket
1 - 160	9/16”	8	Hex Cap Screws	Socket
1 - 180	1 - 1/2”	2	Stop Screws	Open End or Adjustable
3 - 20	3/4” sq.	2	Tie Bar (female square)	Open End or Adjustable
3 - 40	3/4” sq.	1	Piston Rod	Male Drive
3 - 90	3 - 1/2”	2	Heavy Hex Nuts	Socket
3 - 100	1 - 5/16”	8	Hex Cap Screws	Socket
3 - 120	1 - 5/16” sq.	1	Pipe Plug	Open End or Adjustable
3 - 130	3/16”	2	Socket Cap Screws	Allen
5 - 20	1 - 1/8”	8	Hex Cap Screws	Socket
7 - 80	1 - 5/16”	8	Hex Cap Screws	Socket
7 - 100	1 - 5/16”	8	Hex Cap Screws	Socket
7 - 110	9/16”	1	Flush Socket Head Pipe Plug	Allen
7 - 130	9/32” sq.	1	Square Head Pipe Plug	Open End or Adjustable
12	1”	1	Breather Assembly	Open End
13	3/4”	2	Vent Check Assembly	Open End
-	3/4”	1	Tension Rod	Male Drive

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