

tech-motive tool

66 SERIES

DC Electric Fastening Tools

Technical Information and Drawings

USA-based Advanced Assembly Group manufactures  torque products and  nutrunners and controllers and integrates them into complete assembly fastening and test systems.

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66 Series Fastening Tools

Thank you for purchasing the *tech-motive tool* 66 Series intelligent DC electric nutrunner manufactured by Advanced Assembly Group (AAG).

All *tech-motive tool* Intelligent Series tools have an internal microprocessor -- the Intelligent Tool Interface (ITI) module -- which makes setup and calibration automatic upon connection to a CS4000 or CS5000 Controller.

Each 66 Series tool features a digital readout and messaging display in the handle, durable stainless steel head and compact, high-speed design. The rated torque capacity ranges from 25 to 90 Nm for the right angle tools, and 20 to 150 Nm for the in-line tools. The handheld models have a throttle lever for easy operation.



66 Series Right Angle and In-line intelligent DC electric fastening tools

Think Safety First!

Working with fastening tools can be dangerous if safe and proper procedures are not followed. As with all machinery, certain hazards can be involved with the operation of the product. Using these tools with respect and caution will considerably lessen the possibility of personal injury, however, if normal safety precautions are overlooked or ignored personal injury to the operator may result.

Always use common sense and exercise caution when using these tools. They can produce high torque that, unless properly compensated for, could cause personal injury. Remember, your personal safety is *your* responsibility.

Only AAG-qualified service technicians should perform the procedures covered in this manual. If you are an operator or service technician, you should become familiar with the contents of this manual before operating, servicing, or maintaining any part of the CS4000 or CS5000 Fastening System, including the 66 Series fastening tools. Familiarization with all components of the system can minimize the possibility that an accident or injury might occur.

AAG assumes no responsibility for personal injury or damage to equipment resulting from misuse of these tools. After reviewing this manual you should also review all safety procedures provided by your company and the equipment installer.

**WARNING! FAILURE TO FOLLOW THESE RULES
MAY RESULT IN SERIOUS PERSONAL INJURY**

General Machine Safety

- FOR YOUR OWN SAFETY READ THE INSTRUCTION MANUAL THOROUGHLY PRIOR TO OPERATING THE TOOL.
- DO NOT WORK IN A DANGEROUS ENVIRONMENT. Do not use power tools in a damp or wet location or expose them to rain, oils, or corrosive fluids.
- KNOW THE LOCATION OF POWER DISCONNECTS AND EMERGENCY STOP BUTTONS PRIOR TO OPERATING THIS EQUIPMENT.
- KEEP ALL ELECTRICAL PANELS CLOSED DURING OPERATION. High voltage present inside enclosure panels can result in personal injury. Do NOT bypass or defeat electrical safety devices. Turn the power actuator to the OFF position prior to any servicing or maintenance of the controller.
- OBSERVE ALL GOVERNMENT AND/OR COMPANY POWER LOCKOUT STANDARDS.
- NEVER OPERATE SOLENOID VALVES, LIMIT SWITCHES OR RELAYS MANUALLY as this practice can create dangerous, unexpected machine movements.
- SECURE THE TOOL. Tools that develop torque can produce hazardous torque reactions. Always be sure that the tool is properly fixtured to absorb reaction as a fastener is tightened. Never operate a tool capable of high torque without proper fixturing.
- SECURE WORK. Avoid situations where the part being fastened breaks loose and can cause damage.
- NEVER TOUCH OR ATTEMPT TO STOP MOVING MACHINERY OR PARTS WITH YOUR HANDS, OTHER PARTS OF YOUR BODY, OR MAKESHIFT DEVICES.
- DO NOT OPERATE THE TOOL WHILE UNDER THE INFLUENCE OF ALCOHOL, DRUGS OR MEDICATION THAT CAN IMPAIR YOUR JUDGMENT.
- REPORT ALL UNSAFE WORKING CONDITIONS OR PRACTICES TO YOUR SUPERVISOR AND / OR SAFETY DEPARTMENT FOR CORRECTION.
- WEAR APPROVED SAFETY GLASSES AT ALL TIMES.
- DON'T WEAR JEWELRY, especially bracelets and rings, while operating the fastening tools. Keep hands and fingers away from all rotating parts and avoid situations where clothing can become tangled in the tool. Secure loose fitting clothing, neckties, and long hair. Wear medical alert identification cautiously.
- DO NOT OVERREACH. Keep proper footing and balance at all times.
- KEEP YOUR WORK AREA CLEAN. Do not work on or near slippery floors or surfaces. Avoid situations where the tool reacts against unexpected obstacles. Do not operate electrical equipment while standing on a wet floor.
- MAINTAIN TOOLS IN TOP CONDITION. Keep tools properly lubricated and clean. If any wires become frayed or exposed, replace them immediately. Prevent dirt, grease or contaminants from getting into the tool.
- REDUCE THE RISK OF UNINTENTIONAL STARTING. Be careful how the tool is left unattended. Avoid resting it on its throttle lever to prevent false starts.

- **CONTROL THE DIRECTION OF ROTATION.** The reaction torque changes direction when going from forward to reverse. Always be aware in which direction the tool will rotate prior to using it. If the tool is not fixtured this will allow you to brace for the proper direction of torque reaction.
- **CHECK DAMAGED PARTS.** Before further use of a tool, any part of the tool that is damaged should be carefully checked to ensure that it will operate properly and perform its intended function. Check for alignment of moving parts, breakage of parts, mounting, and any other conditions that may affect its operation. Never operate a tool that has damaged or exposed wires. Never operate a tool that has any part of the powertrain, other than the output spindle, exposed.

Electrical Safety

Only qualified and properly trained personnel should perform electrical/electronic troubleshooting and repair. Consider the following electrical system safety guidelines:

- Before you troubleshoot or service a fastening system station, be sure you have an up-to-date and appropriate set of electrical drawings for that station.
- Remove metal items, such as rings, metal necklaces, wristwatches and jewelry, as these can create electrical hazards. Wear medical alert identification cautiously.
- Wear safety glasses, but avoid wearing those that have metal rims or metal side shields.
- It may be necessary to troubleshoot equipment while the power is ON. ONLY qualified, trained personnel should do this. During these instances, open only the panels, doors, or covers which need to be opened. Know the voltage present at all points before you begin troubleshooting.
- Use properly insulated tools when working on electrical equipment to reduce the possibility of shock. Make sure the insulation is adequate to safeguard against the high voltages present.
- If you must work on the electrical system, be sure the main disconnect switch on the power panel is in the OFF position and locked out with locks from each trade involved in the repair.
- Do not attempt to modify or repair the machine without the approval of the proper authorities.
- Use approved fuse pullers when changing fuses.
- Never use jumper wires or fuse substitutes to replace specified fuses.
- Always use fuses of a capacity smaller than or equal to the safe capacity of the line or the equipment it serves.
- Before you work on any circuit, check it with an appropriate testing device to be sure voltage is not present.
- Install temporary wiring as safely as possible and replace it with permanent wiring as soon as possible. Install grounding wherever it is needed in the final installation. If modifications are made to the system wiring, drawings must be revised to illustrate this change.
- Know how to deal with electrical fires properly. Keep carbon dioxide and powder extinguishers handy.

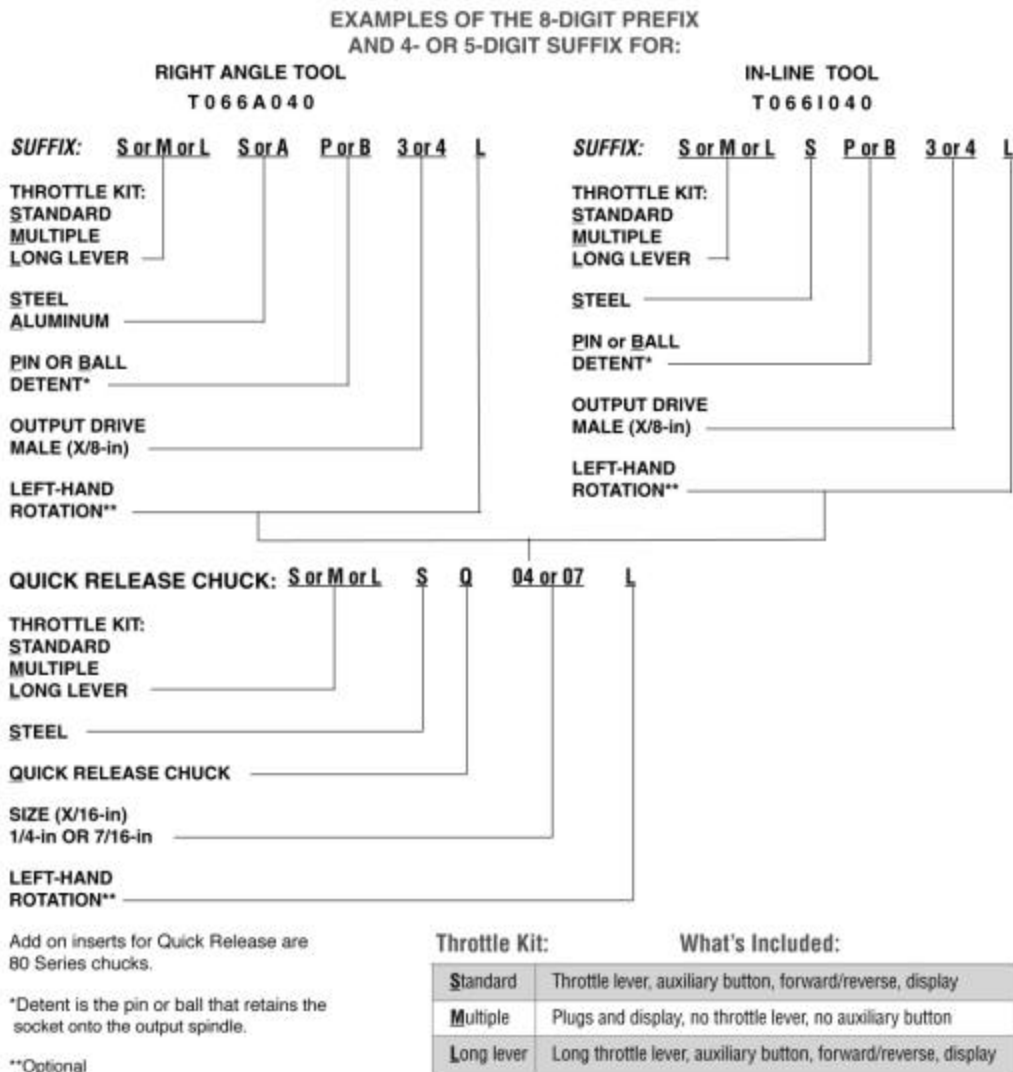
How to Read the Tool Prefix/Suffix

Each "Intelligent Tool" has an 8-digit prefix to describe exactly the kind of fastening tool you will order. This 9-digit prefix may have a 4- or 5-digit suffix, depending on the tool type. Assume that the model number is **T066A040**.

By checking the table, you know that this *tool* is from the **066 series**, has a **right-angle head**, and **40 Nm capacity**. The 8-digit prefix is described in the following table:

T	066	A	040
Tool	Series	Type: Right Angle or In-line	Capacity Nm

The 4- to 5-digit suffix provides more information about the tool and is described in the next table.



Installing the Tool

The 66 Series tool has the ability to tell the controller what its speed and torque capacities are. You may, therefore, need to verify that the tool you have is capable of generating the torque specified in the active parameter set inside the controller. If the tool you are connecting to a controller is not capable of developing the torque specified in the parameter sets inside the controller it will not be allowed to run at all. You should first verify that the tool operates properly before making any changes to it, such as re-positioning the throttle in relationship to the right angle head or re-positioning the display. Refer to *Re-positioning the Tool Throttle* on page 10 and *Re-positioning the Tool Display* on page 12.

Because the 66 Series tools are highly programmable -- through both the factory settings contained in the tool memory as well as the configuration of your particular controller -- there are many possible combinations of tool functionality.

- If your tool has an auxiliary pushbutton installed, you may have it configured to perform one of several functions depending on how the parameter sets inside the controller have been configured.
- If you have a tool configured for reverse rotation, verify the tool rotates in the desired direction.

If you have a Visual Supervisor-based controller (CS4000 Mini Controller or CS5000 Controller), you can look at all of the programmable parameters inside the tool. To do this, open the Visual Supervisor setup program on the PC connected to the CS4000 Mini Controller or the built-in PC in the CS5000 Controller. Then click on the tool icon in the menu tree on the left side of the screen.

If any problem exists or you wish to change or enhance the functionality of your tool, contact your sales agent or the AAG Service Department for assistance.

All 66 Series tools have memory inside them that identifies how the tool was configured as it left the factory. Only authorized factory technicians can change the tool parameters. They will make the changes using a special device, the Model 9500 Tool Programming Module (TPM).

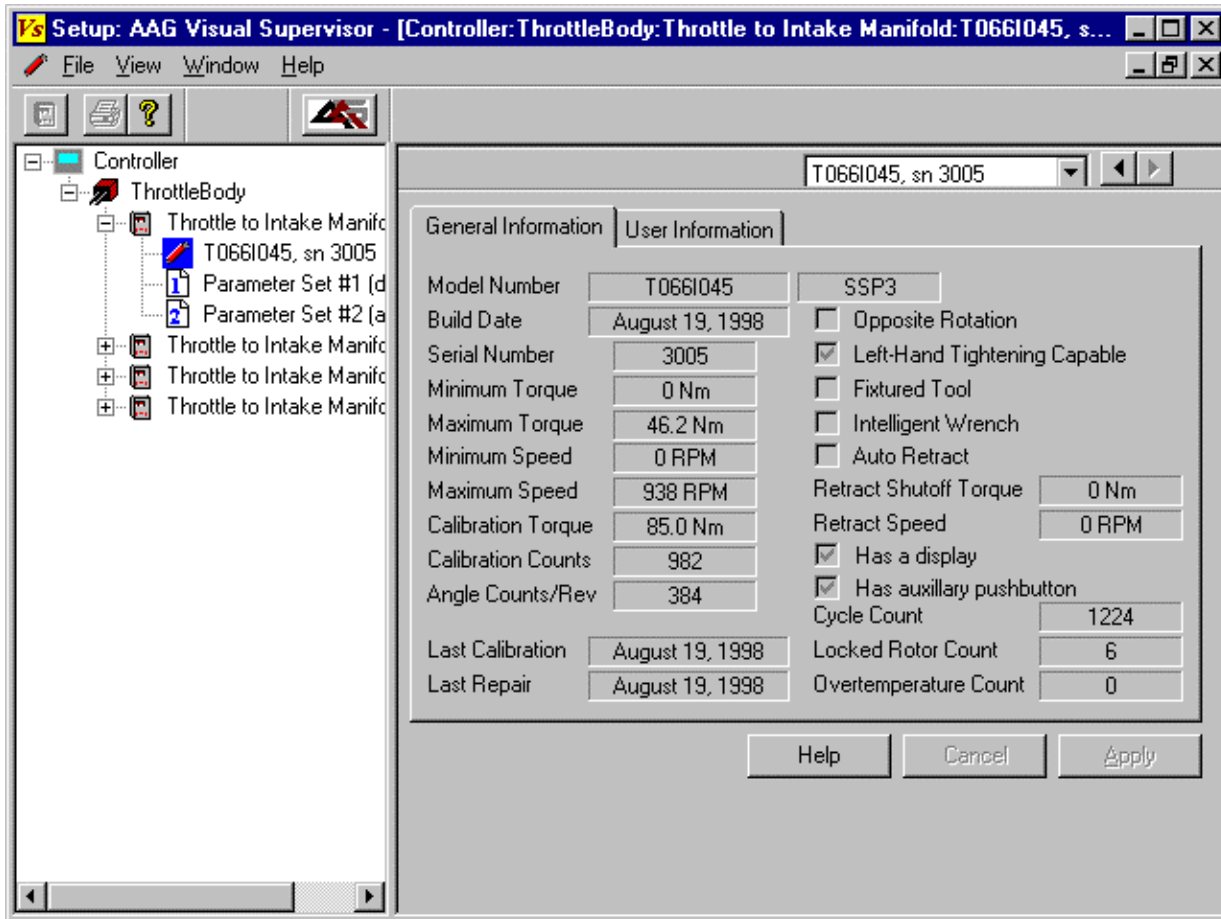
Please note that if you are using the tool with a CS4000 Controller that has a standard Keypad Display Module (KDM) you may not be able to view all of its features.

If you are using the tool with a Visual Supervisor-based controller (CS4000 Mini Controller connected to a PC, or CS5000 Controller), and the tool parameters appear to be what you want, you may open the VS program to check the mapping of the Inputs and Outputs. The enabling and functional definitions of all switches and displays are software selectable through the drag and drop configurations of the Inputs and Outputs.

After you have verified the tool operates as expected, fill out the customer satisfaction survey card and mail it in.

The information that appears under the General Information tab for the selected Tool is displayed when an Intelligent tool is attached to the controller. The Intelligent Tool Interface (ITI) board inside the Intelligent tool transmits data to the controller’s Tool Control Module (TCM) and Device Control Module (DCM), which is inside the TCM.

If no tool is attached, the General Information tab, the User Information tab, and all parameter set and sequence tabs are unavailable.



The values on the General Information tab vary with the attached tool.

In the following table, all of the left column fields are defined in the order they appear on your screen, followed by all the second column fields.

1st Column Field	Definition
Model Number	AAG/ <i>tech-motive tool</i> part number for the fastening tool.
Build Date	The date the tool was manufactured.
Serial Number	Alphanumeric serial number of the fastening tool.
Minimum Torque	Minimum usable torque value (in Nm) for the fastening tool. The controller reads this information from the tool and prevents you from using the tool on any application whose target torque is BELOW this value.
Maximum Torque	Maximum usable torque value (in Nm) for the fastening tool. The controller reads this information from the tool and prevents you from using the tool on any application whose target torque is ABOVE the maximum usable torque value of the tool.
Minimum Speed	Minimum usable speed in revolutions per minute (RPM) of the fastening tool.
Maximum Speed	Maximum free speed value (in RPM) of the fastening tool.
Calibration Torque	The torque calibration value (in Nm) of the fastening tool.
Calibration Counts	The analog-to-digital reading (in A to D counts) that the controller reads from the tool when the shunt calibration circuit in the tool is activated.
Angle Counts/Rev	The angle scaling factor (in counts per revolution) for the fastening tool.
Last Calibration	The date the fastening tool was last calibrated.
Last Repair	The date the fastening tool was manufactured or last repaired.
2nd Column Field	Definition
Opposite Rotation	When checked, indicates the tool is an opposite rotation tool: for a right-handed fastener torque cycle, the tool motor is run in the reverse direction, and the torque and angle signals are negative going. When unchecked, indicates the tool is a standard rotation tool: for a right-handed fastener torque cycle, the tool motor is run in the forward direction, and the torque and angle signals are positive-going.
Left-Hand Tightening Capable	When checked, indicates that the tool has been modified for use in left-hand fastening applications (for example, reverse torque cycles, such as tightening a left-hand threaded fastener).
Fixtured Tool	When checked, indicates that the tool is designed for fixtured applications and has no on-board controls for cycle start or direction.
Intelligent Wrench	When checked, indicates that the tool is not a nutrunner, but an intelligent hand torque wrench.
Auto Retract	When checked, indicates that the tool is a tubenut tool and that the output socket must be retracted to the open position when the tool trigger is released.
Retract Shutoff Torque	When Auto Retract is checked, defines the shutoff torque setting (in engineering units) for tubenut tools.
Retract Speed	When Auto Retract is checked, defines the speed setting (in engineering units) for tubenut tools.
Has a display	When checked, indicates that a 66 Series tool is attached. The 66 Series tools are the only intelligent tools that have a digital display.
Has auxiliary pushbutton	When checked, indicates that a 66 Series tool with an auxiliary pushbutton is attached.
Cycle Count	The total number of rundown cycles the fastening tool has performed.
Locked Rotor Count	The total number of locked rotor faults the fastening tool has had.
Overtemperature Count	The total number of motor overheating faults the tool has had. Such faults occur when the winding temperature is higher than 125 degrees Celsius.

Use the following procedure to install the 66 Series tool to the Controller.

Installing the Tool

1. Remove the tool from the box.
2. Connect the small end of the tool cable to the tool, and the large end of the cable to the controller.
3. Apply power to the controller.

You will see messages on both the controller and the tool displays during initialization, and the tool lights will flash momentarily.

NOTE: If the tool lights continue to flash, read the scrolling message on the tool display. Typically, this will read “Invalid Parameter Set X”. Fix the parameter set in the controller (via the KDM for the CS4000 Controllers, or the Visual Supervisor program for the CS4000 single-channel Mini or CS5000 Controllers).

- Refer to *Viewing and Changing the Spindle Parameter Sets* in *Chapter 8, The Setup Menu* in the *CS4000 Controller Technical Reference Manual*
 - In VS, click on the Parameter Set with the red slash and the tab with the red slash, and correct the value that is highlighted in red.
4. Become familiar with how the tool operates and feels. Push the throttle button and cycle the tool in the air (off a bolt). Push the forward/reverse button and watch the output drive change direction. Push the auxiliary button and note the display.

Re-positioning the Tool Throttle

The position of the tool throttle (operating button) on the 66 Series tool can be changed to accommodate the operator.

WARNING! MAKE SURE THE THROTTLE IS IN A POSITION THAT IS APPROPRIATE FOR THE FASTENING TASK.

- *For applications requiring clockwise torque only, the throttle must be positioned on the TOP or BOTTOM of the tool or FACING the operator.*
- *For applications requiring left-hand tightening (counterclockwise rotation), the throttle must be positioned on the TOP or BOTTOM of the tool or FACING AWAY FROM the operator.*

Re-positioning the Right Angle Head

Use the following procedure to re-position the Right Angle head on the tool.

Re-positioning the Right Angle Head Throttle

1. Place the cable end of the tool in a vise so that the flats are positioned on the vise jaws.
2. Position a 3/16-inch diameter spanner wrench in one of the holes on the tool's black clamping collar.
3. Pulling the wrench clockwise, the collar should loosen.

NOTE: You might have to extend the spanner wrench handle with a small pipe in order to have enough pulling force to loosen the collar.

4. With the tool still in the vise, loosen the collar by hand until the collar is fully unscrewed from the head.
5. Carefully lift the head slightly away from the collar and gearing, and rotate the head to the desired position.
6. Carefully align the splines inside the head with the splines on the gearing and transducer assembly. Using a very slight left-to-right motion, you will be able to feel when the splines are aligned.
7. Slowly tighten the black clamping collar counterclockwise to the head.

NOTE: If you feel resistance while tightening the collar onto the head, you must rotate the output spindle of the head to align the output drive spline to the gearing. Continue to tighten the collar until it is fully engaged. If you continue to tighten the collar and you don't feel resistance, the output drive spline is aligned to the gearing.

8. Position the 3/16-inch diameter spanner wrench in one of the holes on the collar, and pull the wrench in a counterclockwise direction to finish tightening the collar.
9. Remove the tool from the vise.

Replacing the Tool Display Module

Use the following procedure to replace the Display Module on the tool.

Replacing the Tool Display Module

NOTE: Before you begin this procedure, make sure you have a replacement display module (part number 486630-33915), replacement lens (from the lens kit, part number A066-LNSKT) and the special button removal/installation tool (part number 49-40-33842).

1. Using a 5/64-inch Allen wrench, remove the two hex head screws retaining the throttle lever.
2. Remove the throttle lever.
3. Using the special button removal/installation tool (part number 49-40-33842), remove the operating and auxiliary buttons (or plugs).
4. Slide the O-ring over the display and off the handle of the tool.
5. Carefully slide the red sleeve off the handle of the tool.
6. Locate the J20 connector on the ITI board.

The connector is on the same side of the board as the display.
7. Using a sharp knife, trace the perimeter of the lens to cut through the factory installed silicone sealant.
8. Remove both the lens and the display by sliding a sharp object along the side of the lens, then pry the lens upward.

The lens and display should come out together.
9. Slide the display's four colored wires and white connector (J20) out of the handle.
10. Install a new display (part number 486630-33915) by sliding the white connector into the large opening in the handle.
11. Plug the white connector into J20 on the ITI board.

NOTE: If the lens you removed has been damaged, replace it with a new lens from the lens replacement kit (part number A066-LNSKT).
13. Liberally coat the pocket sides and lens edges with Dow Corning's RTV 732 Black Silicone Sealant.
14. Snap the new lens and Display Module into the tool until the locking barbs grab into the machined groove with a snapping action.
15. Be sure that no wires coming off the display are pinched.
16. Run a thin film of sealant around the perimeter of the lens and wipe off any excess with a soft rag.
17. Slide the red sleeve onto the tool handle until it meets the collar.
18. Slide the O-ring over the handle and display until it meets the red sleeve.

19. Using the special button removal/installation tool (part number 49-40-33842), install the operating and auxiliary buttons (or plugs).
20. Position the throttle lever over the operating button and align the holes of the throttle with the holes in the handle.
21. Using the 5/64-inch Allen wrench, retain the throttle to the handle by installing the two hex screws.

Re-positioning the Tool Display

When the 66 Series tool was designed provisions were made to allow it to be mounted in as many positions as possible. The Display Module is mounted by sliding it into grooves molded into the lens, then the lens is pushed into the tool until a ridge molded into the lens snaps into a groove that is machined into the housing.

Display can be positioned four ways to accommodate vertical and left-hand use of tool



The Display Module is perfectly square and it mounts into the lens at any of the four 90-degree orientations. A lens replacement kit (AAG part number A066-LNSKT) contains five replacement lenses. To change the position of the display, use the following procedure:

Re-positioning the Tool Display

NOTE: Before you begin this procedure, make sure you have replacement lens (from the lens kit, part number A066-LNSKT).

1. Remove both the lens and the display by sliding a sharp object along the side of the lens, then pry the lens upward.
2. The lens and display should come out together.
3. Slide the display out of the old lens, rotate the display to the desired position, and slide the display into a new lens.
4. Liberally coat the pocket sides and lens edges with Dow Corning's RTV 732 Black Silicone Sealant.
5. Snap the new lens and Display Module into the tool until the locking barbs grab into the machined groove with a snapping action.
6. Be sure that no wires coming off the display are pinched.
7. Run a thin film of sealant around the perimeter of the lens and wipe off any excess with a soft rag.

Torque Information at Your Fingertips!

All 66 Series tools have the following features to provide torque information right at your fingertips:

- Programmable auxiliary pushbutton can be used for Cycle Complete, multi-parameter selection, Data Send, etc.
- Forward / reverse switch
- 3 indicator / status lights – by default, yellow for low torque/angle, green for accept, and red for high torque/angle
- 4-character scrolling alphanumeric digital display:
 - Torque information
 - OK and status information
 - 15-character scrolling messages
 - Identification of the active parameter set

Calibrating the Tool to a Joint

NOTE: The Cal value is valid only for the period that the calibrated tool is connected to the CS4000 or CS5000 Controller fastening system. If the calibrated tool is removed and reconnected to another controller, the Cal value will return to the original value that is programmed into the nutrunner's Intelligent Tool Interface (ITI) board.

You can determine the actual calibration value for a nutrunner. To do this, perform several trial rundowns with an external *master* torque transducer installed between the nutrunner output shaft and the fastener being tightened. Note the indicated peak readings from the CS4000/CS5000 Controller and the master transducer to calculate the actual nutrunner calibration value. Use the following procedure to calculate and enter the actual cal value for a right-angle nutrunner.

Calibrating the Nutrunner to a Joint

1. **Install the master torque transducer between the nutrunner output shaft and the drive socket.**
2. **Calibrate the torque transducer/readout box per the manufacturer's instructions.**
3. **Perform at least five rundown cycles with the nutrunner.**
4. **Write down the peak reading from the CS4000 Controller and the master torque transducer.**
5. **Calculate the average CS4000 Controller peak reading and the average master peak reading.**
6. **Using the values obtained in Step 4 and the current CS4000 Controller calibration value, calculate the actual calibration value using the following formula:**

$$\text{NewCalValue} = \frac{\text{AverageMasterReading} * \text{OldCalValue}}{\text{AverageCS4000ControllerReading}}$$

7. **Enter the new calibration value into the CS4000 Controller using the keypad and the *Setup@Spnd@Cal* menu.**

8. If your system is controlled by a CS5000 or a CS4000 Single-Channel Mini Controller running on Visual Supervisor setup software, then you must reprogram the tool using a Model 9500 Tool Programming Module (TPM) and follow the *Read@Edit@Write* routine outlined in the TPM online help.
9. Because the calibration value has changed, the leftmost LED will illuminate on the controller display.
10. Repeat Steps 3 through 8 at least once to ensure the new calibration value is correct.

Troubleshooting the Tool

The CS4000 and CS5000 Controllers have many configurable features and programmable parameters that control the operation of the fastening system equipment. If you apply these features or program the parameters improperly, erroneous data and manufacturing problems can result. Proper setup of the CS4000/CS5000 Controllers is essential in preventing such situations.

Whenever the data seems to be in error or operational problems occur, review the complete list of configurations and parameters. For the CS4000 Controller you can do this by generating a configuration printing if your system is connected to a printer. Refer to the section, *Printing Configuration Information* in *Chapter 11 The Print Menu* in the *CS4000 Controller Technical Reference Manual*. Then refer to *Chapter 5 Installing the Fastening System*, *Chapter 7 The Configuration Menu*, and *Chapter 8 The Setup Menu*, comparing the information in them to the way you have set up your CS4000 Fastening System. For A CS4000 single-channel “Mini” Controller or CS5000 Controller that has the Visual Supervisor (VS) setup software program installed, refer to the online help that is part of the software. Make sure the features needed for the job are selected and all limits have been set according to blueprints or specifications provided at your work site. Disable any features you do not need. Observe the guidelines for the problems listed below.

Tool Runs Erratically

- Power down the system, then power it up and try the tool again.
- Make sure you are not releasing the nutrunner throttle before the tool shuts off automatically.
- Make sure you are not re-hitting the fasteners.
- Try replacing the tool cable.
- Try substituting a different tool.
- Make sure the tool is the proper size for the job.
- For all CS4000 Controllers except the Mini, adjust the downshift value under *Setup@Parm@Speed@DnShf*. Refer to *Setting Rundown (RunDn) and Downshift (DnShf) Speeds* in *Chapter 8 The Setup Menu* in the *CS4000 Controller Technical Reference Manual*. For the CS4000 Mini and all CS5000 Controllers, select the parameter set, click the Speed tab and use the online help in Visual Supervisor for setup.
- For all CS4000/CS5000 Controllers, lower the TACH GAIN and/or TRIM SPEED potentiometers on the servo amplifier. Refer to *Adjusting the Servo Amplifier* in *Chapter*

7 *The Configuration Setup Menu* in the *CS4000 Controller Technical Reference Manual*. For the CS4000 Mini and all CS5000 Controllers, refer to the online help in Visual Supervisor.

- ☑ Contact the *tech-motive tool* Service Department for assistance. Be sure to provide the software revision number for your system. This information is displayed upon system power on.

Tool Does Not Shut Off

- ☑ For all CS4000 Controllers except the Mini, make sure the system has been configured properly. Refer to *Chapter 7 The Configuration Menu* and *Chapter 8 The Setup Menu* in the *CS4000 Controller Technical Reference Manual*. For the CS4000 Mini and all CS5000 Controllers, refer to the online help in Visual Supervisor.
- ☑ For all CS4000 Controllers except the Mini, check the torque target and angle target values under *Setup@Parm@Torq@Targt* and *Setup@Parm@Angle@Targt*. Refer to *Setting the Torque (Torq) Parameters* and *Setting the Angle Parameters* in *Chapter 8 The Setup Menu* in the *CS4000 Controller Technical Reference Manual*. For the CS4000 Mini and all CS5000 Controllers, select the parameter set, then click the Torque/Angle Control tab and make adjustments as needed.
- ☑ Contact the *tech-motive tool* Service Department.

Tool Does Not Hit Target

- ☑ Make sure you are not releasing the nutrunner throttle before the tool shuts off automatically.
- ☑ Is the tool stalling or causing a locked rotor fault (LckRt)?
 - ⇒ Verify the torque specifications for the application.
 - ⇒ Substitute a different tool for the one that is stalling.
 - ⇒ Check for proper input A.C.
 - ⇒ Make sure the tool is properly calibrated to the joint. Refer to *Calibrating the Tool to a Joint* on page 13.
- ☑ Did the rundown reach the High Angle limit? (If so, the tool is running correctly).
 - ⇒ If the joint has been rejected, adjust the angle limits.
- ☑ Did the tool shut off on the target angle? (If so, the tool is running correctly.)
 - ⇒ If the joint has been rejected, adjust the angle limits.
- ☑ Contact the *tech-motive tool* Service Department.

Tool Does Not Run

- ☑ Make sure the GFCI switch is on.
- ☑ Check all fuses. (Replace as necessary, and re-power the system.)
- ☑ Make sure the TCM power LED is on. (If it is not on, check the fuse on the servo amplifier board inside the TCM.)
- ☑ Does an error message appear on the display?
 - ⇒ If it is a Span Error (SpnEr), try replacing the cable.
 - ⇒ If it is an Offset Error (OfEr) or No Tool Detected (NTool) message, try replacing the cable.
- ☑ Does the Motor Enable LED on the TCM come on?
 - If it does:
 - ⇒ Check the programmed speed settings in the controller. (For a controller with a KDM, go to Setup→Parm→Speed→RunDn; for a controller that has Visual Supervisor loaded, Select the Parameter Sets Speed Tab.)
 - If not:
 - ⇒ Try another tool.
 - ⇒ Try another cable.
 - ⇒ Try another TCM.
- ☑ Contact the *tech-motive tool* Service Department.

Tool Runs Hot

- ☑ Is the tool stalling?
 - ⇒ Verify the torque specification for the application.
 - ⇒ Make sure the tool is calibrated properly.
 - ⇒ Try another tool.
- ☑ Make sure the operator is not re-applying torque to the fasteners.
- ☑ Is excessive gear noise coming from the tool? (Repair or replace the tool.)
- ☑ For all CS4000/CS5000 Controllers, make sure the TACH GAIN pot on the servo amplifier is set correctly. Refer to *Adjusting the Servo Amplifier* in *Chapter 7 The Configuration Setup Menu* in the *CS4000 Controller Technical Reference Manual*.
- ☑ Does the joint have a high running torque when the fastener is being rundown? For all CS4000 Controllers except the Mini, raise the downshift torque under *Setup@Parm@Torq?* Refer to *Setting the Prevailing Torque (PrvTq) Parameters* in *Chapter 8 The Setup Menu* in the *CS4000 Controller Technical Reference Manual*. For the CS4000 Mini and all CS5000 Controllers, select the parameter then click on the Speed tab and key in the downshift value.
 - ⇒ Try substituting a tool with a higher torque capacity.
 - ⇒ Try reducing the cycle time.

- ☑ Is the tool being used on a very soft joint?
 - ⇒ Try oversizing the tool.
 - ⇒ Try reducing the cycle time.
- ☑ Reduce the operation cycle time.
- ☑ Contact the *tech-motive tool* Service Department.

Tool LEDs Do Not Work

- ☑ If Visual Supervisor is installed on the controller, make sure that the tool lights have been assigned functions.
- ☑ Verify the internal connection of the tool display assembly. You may have to replace the tool display module. (Refer to *Replacing the Tool Display Module* on page 10.)
- ☑ Is the tool display showing the same message or value as the TCM display?
 - ⇒ Substitute a different tool (same model) for the existing one and check both displays.
 - ⇒ Replace the TCM.
- ☑ Contact the *tech-motive tool* Service Department.

Tool Maintenance

Generally, little preventive maintenance is required of *tech-motive tool* nutrunners. The right-angle head and planetary gear reducer of each nutrunner should be greased every 50,000 cycles using Mobil SCH460 grease.

If the tools are not re-calibrated routinely at your work site, they should be re-calibrated when they are greased.

Advanced Assembly Group recommends that you send the tools back to the factory for preventive maintenance every 250,000 cycles.

Only trained technicians should perform in-depth maintenance, such as motor, transducer, or gearing replacement. The appropriate assembly drawings are provided with this manual.

Tools Required for Repair

The following tools are required for repairing and replacing parts on the 66 Series fastening tools:

- 5/64-inch Allen wrench
- 5/16-inch open end wrench
- Motor holding tool (AAG part number 49-90-27272)
- Small bearing puller
- Small flat tip screwdriver
- Snap ring pliers
- 3/16-inch spanner wrench
- Sun gear removal tool (AAG part number 37-02-35353)
- Special button removal/installation tool – a 1/4-inch spanner socket with a square drive for removing/installing throttle/auxiliary buttons and plugs (AAG part number 49-40-33842). You must install a standard 6-inch driver handle to this with a 1/4-inch square drive to this socket.

Accessories

A variety of cables, mounting plates, reaction bars, mounting bails and other accessories are available for the 66 Series DC electric tools. For more information, please visit our website at <http://www.aagtools.com> then click on the Products button in the left-hand frame. Click on “Tool System Accessories” and scroll through the list and select an item. Scroll through the entire page to view all of the accessories available.

Drawings Information

A series of assembly drawings has been included with this manual. For outline drawings, please visit our website at <http://www.aagtools.com>. Click on the Support button in the left-hand frame. Click “Drawings”. Read the section on Online Documentation, and download the free “WHIP!” viewer software that lets you view the drawings in .dwf file format. Then scroll down to “66 Series Fastening Tools” and click on “Outline drawings – all 66 Series tools.” In the next screen, click on the model number of a tool and you will be able to view the outline drawing.

66 Series Handheld Tools Information

66 Series Right Angle Tools - Handheld

25 to 90 Nm

Used with the CS4000 / CS5000 Controllers

A mounting plate (49-40-35432), but no reaction bar, is available for these models.

MODEL	PART NO.	TORQUE*			RPM*	LENGTH	WEIGHT	OUTPUT
		Nm	lbf-ft	kgcm				
T066A025	T066A025SSP3	25	18.4	2.98	1526	15.6 in / 395 mm	4.0 lb / 1.8 kg	3/8-in
T066A040	T066A040SSP3	40	29.5	4.1	990	16.6 in / 422 mm	4.7 lb / 2.2 kg	3/8-in
T066A075	T066A075SSP4	75	55.3	7.6	550	17.8 in / 453 mm	5.7 lb / 2.6 kg	1/2-in
T066A090	T066A090SSP4	90	66.4	9.2	438	17.8 in / 453 mm	5.7 lb / 2.6 kg	1/2-in

*Nominal torque and RPM are $\pm 10\%$. Output = male square drive. All 66 Series Right Angle tools use double-stage gearing.

66 Series In-line Tools- Handheld

20 to 150 Nm

Used with the CS4000 / CS5000 Controllers

For the 20, 30, 35, and 45 Nm models mounting plates (49-40-35740 and 49-5711-7103) are available. An aluminum reaction bar (49-5803-8111) is included, and a steel reaction bar (49-5803-8105) is optional.

For the 75, 100, and 150 Nm models a mounting plate (49-40-35704) is available, and a reaction bar (49-40-35227) is included.

MODEL	PART NO.	TORQUE*			RPM*	LENGTH	WEIGHT	OUTPUT
		Nm	lbf-ft	kgcm				
T066I020	T066I020SSP3	20	14.8	2.0	2290	14.8 in / 358 mm	3.6 lb / 1.7 kg	3/8-in
T066I030	T066I030SSP3	30	22.1	3.1	1485	14.8 in / 358 mm	3.6 lb / 1.7 kg	3/8-in
T066I035	T066I035SSP3	35	25.8	3.6	1177	14.8 in / 358 mm	3.6 lb / 1.7 kg	3/8-in
T066I045	T066I045SSP3	45	33.2	4.6	937	14.8 in / 358 mm	3.6 lb / 1.7 kg	3/8-in
T066I075	T066I075SSP4	75	55.3	7.6	424	16.1 in / 40.8 mm	4.8 lb / 2.2 kg	1/2-in
T066I100	T066I100SSP4	100	73.8	10.2	345	16.1 in / 40.8 mm	4.8 lb / 2.2 kg	1/2-in
T066I150	T066I150SSP4	150	110.6	15.3	208	16.1 in / 40.8 mm	4.8 lb / 2.2 kg	1/2-in

*Nominal torque and RPM are $\pm 10\%$. Output = male square drive. 20 through 45 Nm tools use double-stage gearing; 75 through 150 Nm tools use triple-stage gearing.

66 Series Fixtured Tools Information

66 Series In-line Tools - Fixtured

20 to 150 Nm

Used with the CS4000 / CS5000 Controllers

For the 20, 30, 35, and 45 Nm models mounting plate (49-40-35740) is included. An optional mounting plate (49-5711-7103), an aluminum reaction bar (49-5803-8111) and a steel reaction bar (49-5803-8105) are available.

For the 75, 100, and 150 Nm models a mounting plate (49-40-35704) is included. An optional sliding spindle mounting plate (49-40-35054) and a reaction bar (49-40-35227) are available.

MODEL	PART NO.	TORQUE*			RPM*	LENGTH	WEIGHT	OUTPUT
		Nm	lbf-ft	kgfm				
T066I020	T066I020MSP3	20	14.8	2.0	2290	14.8 in / 358 mm	3.6 lb / 1.7 kg	3/8-in
T066I030	T066I030MSP3	30	22.1	3.1	1485	14.8 in / 358 mm	3.6 lb / 1.7 kg	3/8-in
T066I035	T066I035MSP3	35	25.8	3.6	1177	14.8 in / 358 mm	3.6 lb / 1.7 kg	3/8-in
T066I045	T066I045MSP3	45	33.2	4.6	937	14.8 in / 358 mm	3.6 lb / 1.7 kg	3/8-in
T066I075	T066I075MSP4	75	55.3	7.6	424	16.1 in / 40.8 mm	4.8 lb / 2.2 kg	1/2-in
T066I100	T066I100MSP4	100	73.8	10.2	345	16.1 in / 40.8 mm	4.8 lb / 2.2 kg	1/2-in
T066I150	T066I150MSP4	150	110.6	15.3	208	16.1 in / 40.8 mm	4.8 lb / 2.2 kg	1/2-in

*Nominal torque and RPM are $\pm 10\%$. Output = male square drive. 20 through 45 Nm tools use double-stage gearing; 75 through 150 Nm tools use triple-stage gearing.

66 Series Right Angle Tools - Fixtured

25 to 90 Nm

Used with the CS4000 / CS5000 Controllers

A mounting plate (49-40-35432) is included, but no reaction bar is available for these models.

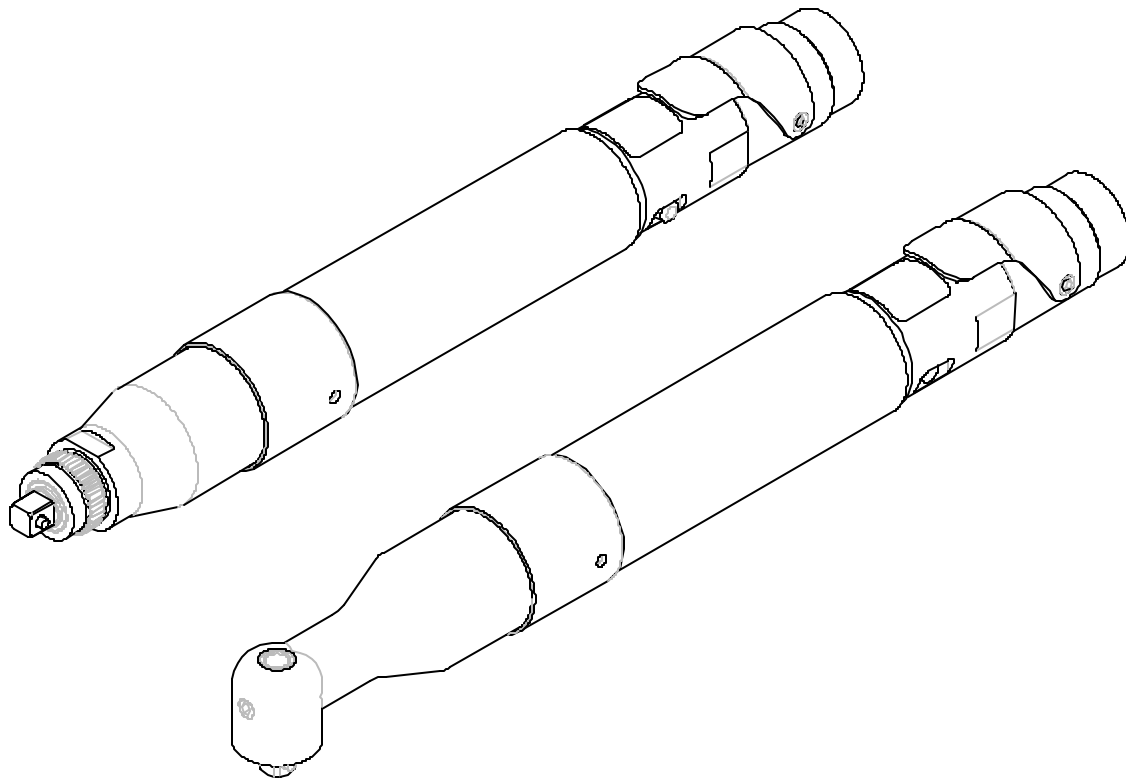
MODEL	PART NO.	TORQUE*			RPM*	LENGTH	WEIGHT	OUTPUT
		Nm	lbf-ft	kgfm				
T066A025	T066A025MSP3	25	29.5	4.1	1526	15.6 in / 395 mm	4.0 lb / 1.8 kg	3/8-in
T066A040	T066A040MSP3	40	29.5	4.1	990	16.6 in / 422 mm	4.7 lb / 2.2 kg	3/8-in
T066A075	T066A075MSP4	75	55.3	7.6	550	17.8 in / 453 mm	5.7 lb / 2.6 kg	1/2-in
T066A090	T066A090MSP4	90	66.4	9.2	438	17.8 in / 453 mm	5.7 lb / 2.6 kg	1/2-in

*Nominal torque and RPM are $\pm 10\%$. Output = male square drive. All 66 Series Right Angle tools use double-stage gearing.

66 Series Tool Drawings

Drawings for the 66 Series Tools are included in this section. Refer to the contents listing below.

Part Number Configuration.....	23
Final Assemblies	
Right Angle Tool Assembly.....	25
Right Angle Tool Bill of Material	27
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Inline Tool Bill of Material.....	31
Motor/Handle Assembly	33
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20 Nm Inline Head Assembly – Double Stage.....	43
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30 - 40 Nm Inline Head Assembly – Double Stage	47
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Gear Case Assembly.....	53
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8 DIGIT PREFIX: T 0 6 6 A 0 4 0

IDOL (TECH-MOTIVE) ——— T

TDOL SERIES ——— 0

NUTRUNNER TYPE: RIGHT ANGLE
IN LINE
DROWS FOOT
TUBE NUT
HDL-D-N-DRIVE
EYSTOLS } ——— 6 6

CAPACITY (NM) ——— A 0 4 0

SUFFIX: S S P 3 L

THROTTLE KIT } ——— S

STEEL } ——— S

PIN/BALL } ——— P

DETTENT } ——— P

OUTPUT DRIVE } ——— 3

MALE (3/8") } ——— 3

"L" REPRESENTS } ——— L

LEFT HAND ROTATION }

SUFFIX: M S P 3 L

THROTTLE KIT } ——— M

STEEL } ——— S

PIN/BALL } ——— P

DETTENT } ——— P

OUTPUT DRIVE } ——— 3

MALE (3/8") } ——— 3

"L" REPRESENTS } ——— L

LEFT HAND ROTATION }

QUICK RELEASE: S S Q O 7 L

THROTTLE KIT } ——— S

STEEL } ——— S

QUICK RELEASE CHUCK } ——— Q

SIZE 1/8 (IN) } ——— O

1/4" OR 7/16 } ——— 7

"L" REPRESENTS } ——— L

LEFT HAND ROTATION }

ADD-ONS

- SLIDING SPINDLES
- OFFSET DRIVES
- SUSPENSION BAIS
- 90 DEG CABLE CONNECTOR
- PLATES, REACTION BARS, ETC.

THROTTLE KIT

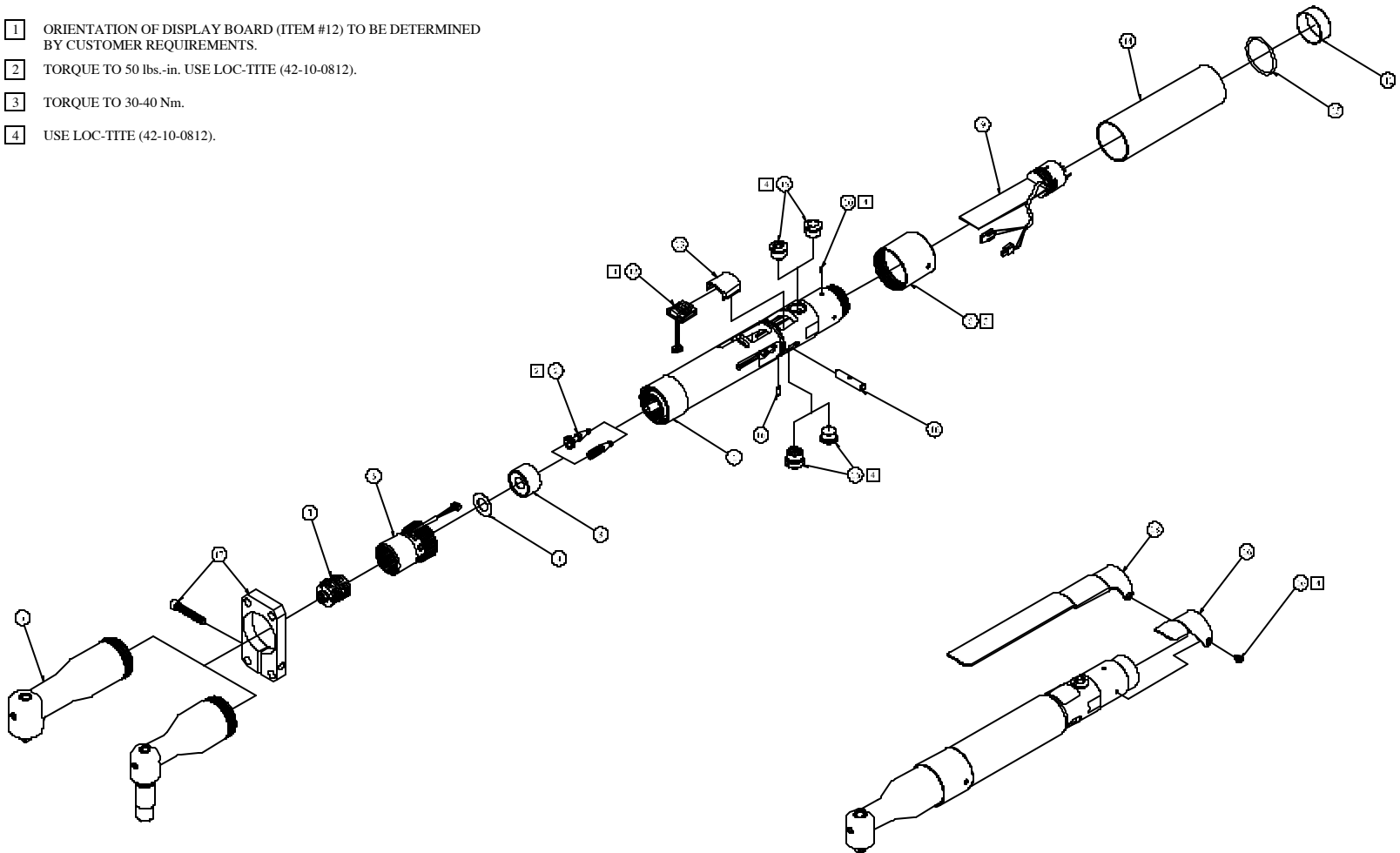
- 3/8" (THROTTLE LEVER, AUXILIARY BUTTON, DISPLAY) (STANDARD)
- 1/2" (NO THROTTLE, NO AUXILIARY BUTTON, DISPLAY) (MULTIPLE)

T066 SERIES RIGHT ANGLE

ITEM NUMBERS CORRESPOND TO THOSE ON NEXT PAGE

NOTES:

- 1 ORIENTATION OF DISPLAY BOARD (ITEM #12) TO BE DETERMINED BY CUSTOMER REQUIREMENTS.
- 2 TORQUE TO 50 lbs.-in. USE LOC-TITE (42-10-0812).
- 3 TORQUE TO 30-40 Nm.
- 4 USE LOC-TITE (42-10-0812).



T066 SERIES RIGHT ANGLE PARTS LIST

ITEM NUMBERS CORRESPOND TO THOSE ON PREVIOUS PAGE

BILL OF MATERIAL			
QTY REQ'D	ITEM NO.	PART NO.	DESCRIPTION
 	 	SEE CHART	T066 SERIES
1	1	483066-1330A	MOTOR ASSEMBLY
1	2	SEE CHART	SUN GEAR
1	3	49-40-34591	SPACER, GEARING
1	4	32-20-7113	WASHER, THRUST
1	5	SEE CHART	HEAD ASSEMBLY
1	6	SEE CHART	TORQUE X'DUCER ASSY.
1	7	SEE CHART	GEARCASE ASSEMBLY
1	8	49-40-35279	COLLAR, CLAMPING
1	9	486630-35237	ITI BRD & INT. HARNESS ASSY
2	10	38-28-8300	SET SCREW #8-32x3/16
1	11	31-80-0378	STOCK CAP, RED
1	12	486630-33915	DISPLAY BOARD, PC864-C
1	13	49-40-34720	LENS, DISPLAY
.5	14	49-30-26359	COVER
1	15	31-80-6018	O-RING
1	16	SEE CHART	KIT, THRTL & PARMTR. / PLUG
1	17	SEE CHART	REACTION ASSEMBLY
1	18	49-70-35351	LONG THROTTLE LEVER

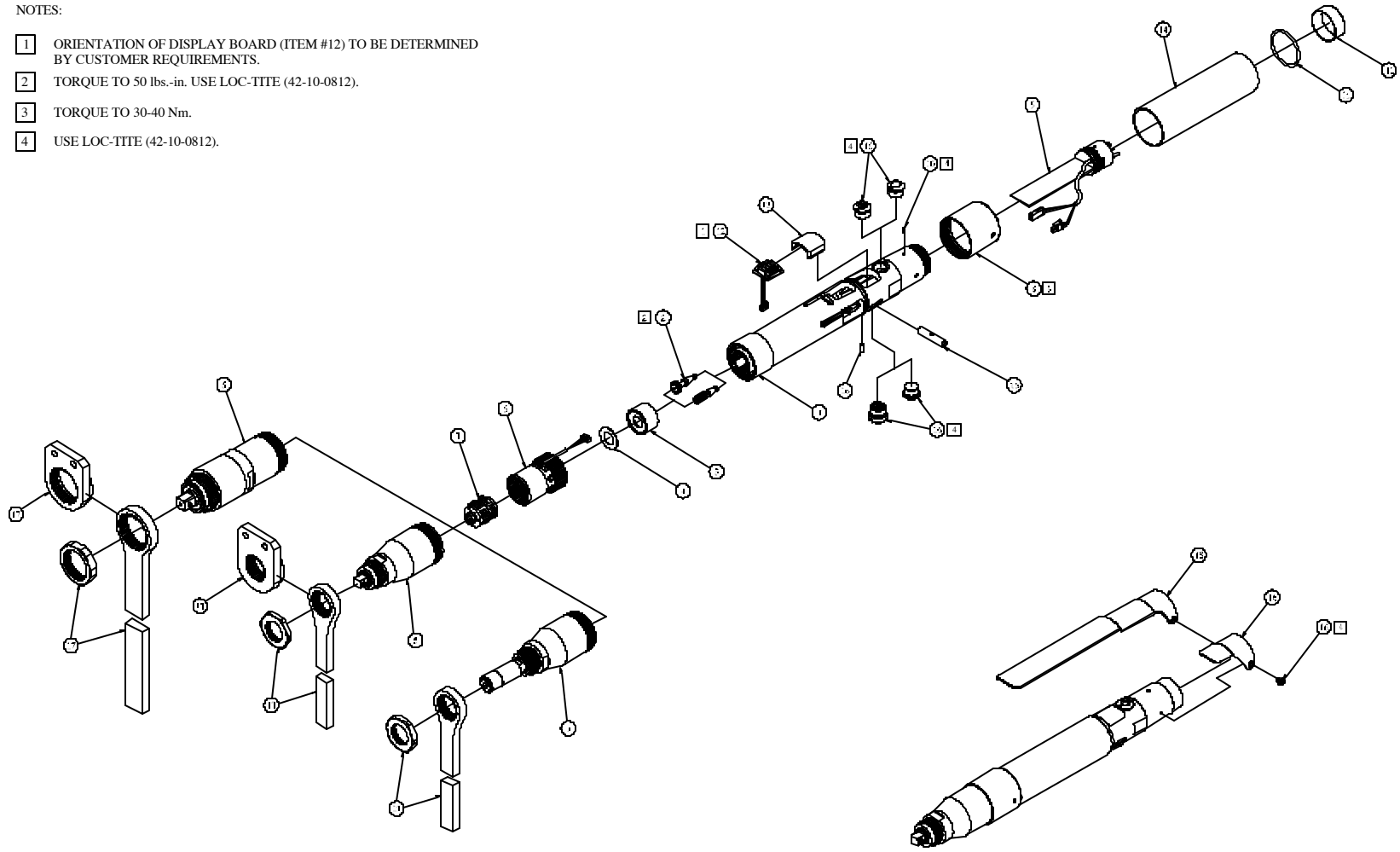
TOOL #	ITEM #2 SUN GEAR	ITEM #5 HEAD ASSY	ITEM #6 TRANSDUCER	ITEM #7 GEARING ASSY	ITEM #16 BUTTON ASSY	ITEM #17 REACTION ASSY
T066A025MSP3	49-10-34268	486630-25SP3	481666-01301	483066-0013	483066-M	A066-RAP
T066A025SSP3		486630-25SB3			483066-S	N/A
T066A025MSB3		486630-25Q025			483066-M	A066-RAP
T066A025SSB3		486630-25Q438			483066-S	N/A
T066A025SSQ04L		486630-25Q438			483066-S	N/A
T066A025SSQ07L	49-10-34266	486630-40SP3	481666-01301	483066-0020	483066-M	A066-RAP
T066A040MSP3		486630-40SB3			483066-S	N/A
T066A040SSP3		486630-40SP4			483066-M	A066-RAP
T066A040MSB3		486630-40SB4			483066-S	N/A
T066A040SSB3		486630-90SP4			483066-M	A066-RAP
T066A075MSP4	49-10-34266	486630-90SP4	481666-01601	483066-0025	483066-S	N/A
T066A075SSP4		486630-90SB4			483066-M	A066-RAP
T066A075MSB4		486630-90SB4			483066-S	N/A
T066A075SSB4		486630-90SP4			483066-M	A066-RAP
T066A090MSP4		486630-90SP4			483066-S	N/A
T066A090SSP4	49-10-34267	486630-90SB4	481666-01601	483066-0032	483066-M	A066-RAP
T066A090MSB4		486630-90SB4			483066-S	N/A
T066A090SSB4		486630-90SB4			483066-S	N/A

T066 SERIES INLINE

ITEM NUMBERS CORRESPOND TO THOSE ON NEXT PAGE

NOTES:

- 1 ORIENTATION OF DISPLAY BOARD (ITEM #12) TO BE DETERMINED BY CUSTOMER REQUIREMENTS.
- 2 TORQUE TO 50 lbs.-in. USE LOC-TITE (42-10-0812).
- 3 TORQUE TO 30-40 Nm.
- 4 USE LOC-TITE (42-10-0812).



T066 SERIES INLINE PARTS LIST

ITEM NUMBERS CORRESPOND TO THOSE ON PREVIOUS PAGE

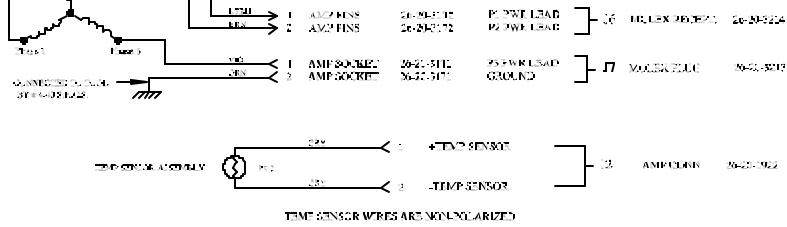
BILL OF MATERIAL			
QTY REQ'D	ITEM NO.	PART NO.	DESCRIPTION
X	X	SEE CHART	T066 SERIES
1	1	483066-1330A	MOTOR ASSEMBLY
1	2	SEE CHART	SUN GEAR
1	3	49-40-34591	SPACER, GEARING
1	4	32-20-7113	WASHER, THRUST
1	5	SEE CHART	HEAD ASSEMBLY
1	6	SEE CHART	TORQUE X'DUCER ASSY.
1	7	SEE CHART	GEARCASE ASSEMBLY
1	8	49-40-35279	COLLAR, CLAMPING
1	9	486630-35237	ITI BRD & INT. HARNESS ASSY
2	10	38-28-8300	SET SCREW #8-32x3/16
1	11	31-80-0378	STOCK CAP, RED
1	12	486630-33915	DISPLAY BOARD, PC864-C
1	13	49-40-34720	LENS, DISPLAY
.5'	14	49-30-26359	COVER
1	15	31-80-6018	O-RING
1	16	SEE CHART	KIT, THRTL & PARMTR. / PLUG
1	17	SEE CHART	REACTION ASSEMBLY
1	18	49-70-35351	LONG THROTTLE LEVER

TOOL No.	ITEM #2 SUN GEAR	ITEM #5 HEAD ASSY	ITEM #6 TRANSDUCER	ITEM #7 GEARING ASSY	ITEM #16 BUTTON ASSY	ITEM #17 REACTION ASSY
T066I020MSP3	49-10-34268	486630-P2375	481666-01301	483066-0013	483066-M	A066-IL2P
T066I020SSP3		483066-S			A066-IL2R	
T066I020MSB3		486630-B2375			483066-M	A066-IL2P
T066I020SSB3		486630-Q2025			483066-S	A066-IL2R
T066I020SSQ04L		486630-Q20438				
T066I020SSQ07L						
T066I030MSP3	49-10-34266	486630-P1375	481666-01301	483066-0020	483066-M	A066-IL2P
T066I030SSP3		483066-S			A066-IL2R	
T066I030MSB3		486630-B1375			483066-M	A066-IL2P
T066I030SSB3		483066-S			A066-IL2R	
T066I035MSP3	49-10-34266	486630-P1375	481666-01601	483066-0025	483066-M	A066-IL2P
T066I035SSP3		483066-S			A066-IL2R	
T066I035MSB3		486630-B1375			483066-M	A066-IL2P
T066I035SSB3		483066-S			A066-IL2R	
T066I045MSP3		483066-M			A066-IL2P	
T066I045SSP3	49-10-34267	486630-P1375	481666-01601	483066-0032	483066-S	A066-IL2R
T066I045MSB3		486630-B1375			483066-M	A066-IL2P
T066I045SSB3		483066-S			A066-IL2R	
T066I045SSB3		483066-M			A066-IL2P	
T066I075MSP4	49-10-34266	486630-P1135	481666-01301	483066-0020	483066-M	A066-IL3P
T066I075SSP4		483066-S			A066-IL3R	
T066I075MSB4		486630-B1135			483066-M	A066-IL3P
T066I075SSB4		483066-S			A066-IL3R	
T066I100MSP4	49-10-34266	486630-P1145	481666-01301	483066-0020	483066-M	A066-IL3P
T066I100SSP4		483066-S			A066-IL3R	
T066I100MSB4		486630-B1145			483066-M	A066-IL3P
T066I100SSB4		483066-S			A066-IL3R	
T066I150MSP4	49-10-34267	486630-P1145	481666-01601	483066-0032	483066-M	A066-IL3P
T066I150SSP4		483066-S			A066-IL3R	
T066I150MSB4		486630-B1145			483066-M	A066-IL3P
T066I150SSB4		483066-S			A066-IL3R	

MOTOR / HANDLE ASSEMBLY

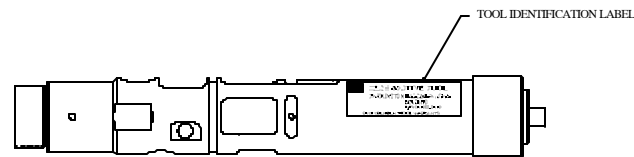
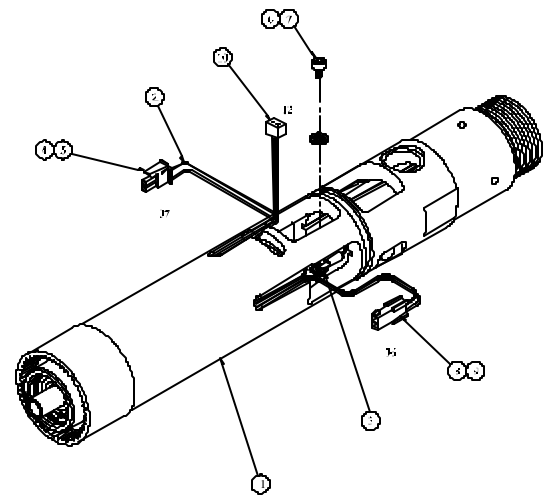


WIRING DIAGRAM



PRODUCTION TOOLING

TOOLING FOR MOLEX PLUG 26-20-3213 & MOLEX PIN 26-20-3171
 APPLICATOR: MOLEX #11-01-0200
 TOOLING FOR MOLEX RECEPT. & MOLEX PIN 26-20-3172
 APPLICATOR: MOLEX #11-01-0201
 EXTRACTOR: MOLEX #11-03-0043



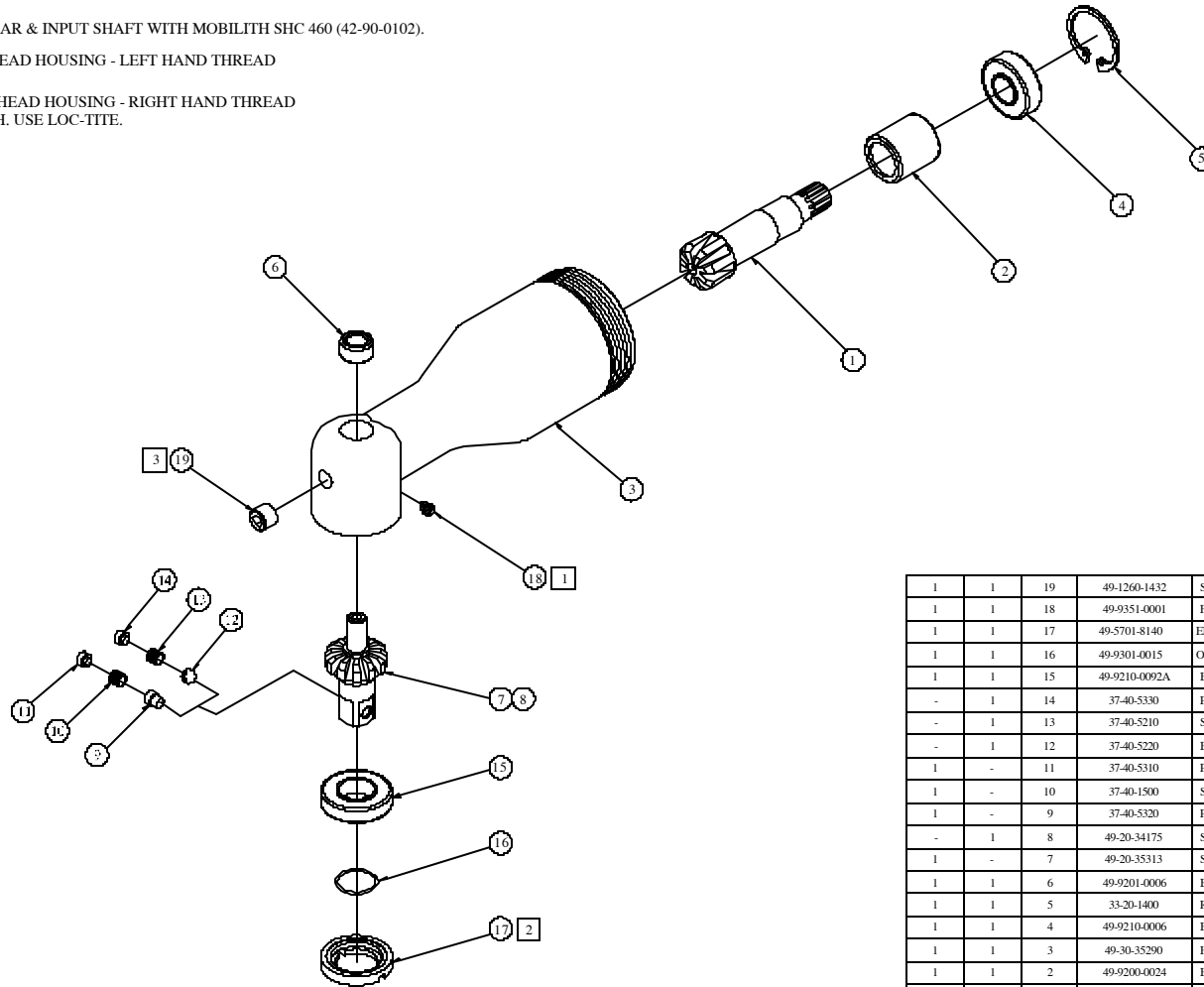
1	10	26-20-1922	CONNECTOR
1	9	26-20-3214	CONNECTOR PIN
2	8	26-20-3172	CONNECTOR, MALE
1	7	38-20-8550	SOCKET HEAD CAP SCREW, 4-40x1/4
1	6	38-20-1200	WASHER, LOCK, #4
1	5	26-20-3213	CONNECTOR RECEPTACLE
2	4	26-20-3171	CONNECTOR, FEMALE
1	3	27-40-0081	TERMINAL, RING, #4
4"	2	22-20-3520	WIRE, GREEN, 22AWG
1	1	49-40-35278	HANDLE, 66 SERIES
		483066-1330A	MOTOR/HANDLE ASSEMBLY, 66 SERIES
QTY REQD	ITEM NO.	PART NO.	DESCRIPTION/MATERIAL

BILL OF MATERIAL

25 Nm RIGHT ANGLE HEAD ASSEMBLY

NOTES:

- 1 LUBRICATE BEVEL GEAR & INPUT SHAFT WITH MOBILITH SHC 460 (42-90-0102).
- 2 END NUT TO ANGLE HEAD HOUSING - LEFT HAND THREAD
TORQUE TO 35 lbs.-ft.
- 3 END PLUG TO ANGLE HEAD HOUSING - RIGHT HAND THREAD
TIGHTEN UNTIL FLUSH. USE LOC-TITE.

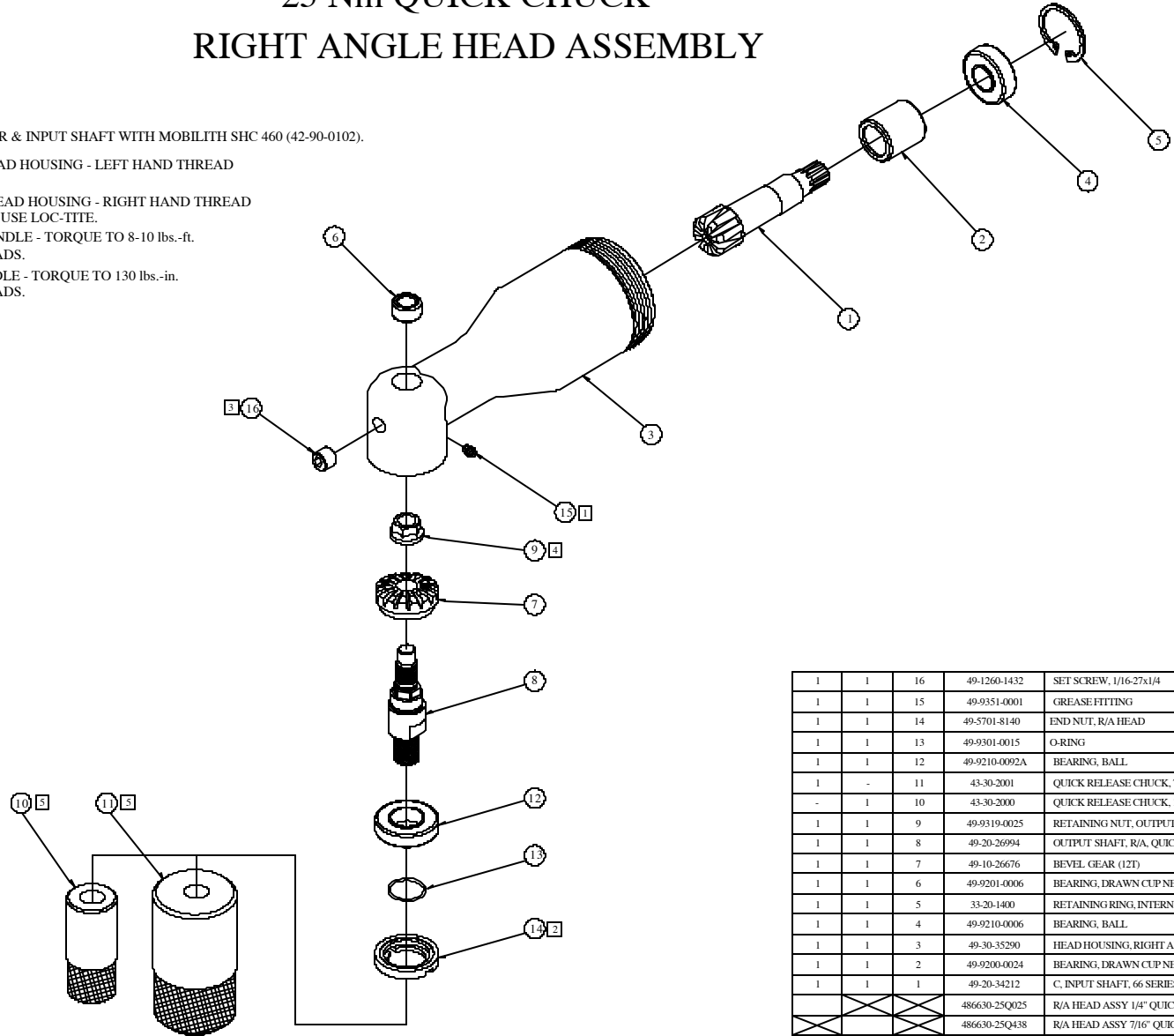


1	1	19	49-1260-1432	SET SCREW - 1/16-27x1/4 P.T.
1	1	18	49-9351-0001	FITTING, GREASE
1	1	17	49-5701-8140	END NUT, HEX - RIGHT ANGLE
1	1	16	49-9301-0015	O-RING
1	1	15	49-9210-0092A	BEARING, BALL, SINGLE ROW, 2 SEALS
-	1	14	37-40-5330	PLUG - 3/8" DRIVE, BALL
-	1	13	37-40-5210	SPRING - 3/8" DRIVE, BALL
-	1	12	37-40-5220	BALL, 3/16" DIA. - 3/8" DRIVE
1	-	11	37-40-5310	PLUG - 3/8" DRIVE, PIN
1	-	10	37-40-1500	SPRING - 3/8" DRIVE, PIN
1	-	9	37-40-5320	PIN - 3/8" DRIVE
-	1	8	49-20-34175	SHAFT, OUTPUT, BALL - 66 SERIES
1	-	7	49-20-35313	SHAFT, OUTPUT, PIN - 66 SERIES
1	1	6	49-9201-0006	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	5	33-20-1400	RETAINING RING - INTERNAL
1	1	4	49-9210-0006	BEARING, BALL
1	1	3	49-30-35290	HOUSING, HEAD, RIGHT ANGLE
1	1	2	49-9200-0024	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	1	49-20-34212	SHAFT, INPUT - 66 SERIES
			486630-25SB3	HEAD ASSY, RIGHT ANGLE - BALL
			486630-25SP3	HEAD ASSY, RIGHT ANGLE - PIN
QTY REQD	ITEM NO.	PART NO.	DESCRIPTION/MATERIAL	
BILL OF MATERIAL				

25 Nm QUICK CHUCK RIGHT ANGLE HEAD ASSEMBLY

NOTES:

- 1 LUBRICATE BEVEL GEAR & INPUT SHAFT WITH MOBILITH SHC 460 (42-90-0102).
- 2 END NUT TO ANGLE HEAD HOUSING - LEFT HAND THREAD
TORQUE TO 35 lbs.-ft.
- 3 END PLUG TO ANGLE HEAD HOUSING - RIGHT HAND THREAD
TIGHTEN UNTIL FLUSH. USE LOC-TITE.
- 4 RETAINING NUT TO SPINDLE - TORQUE TO 8-10 lbs.-ft.
USE LOCTITE ON THREADS.
- 5 QUICK CHUCK TO SPINDLE - TORQUE TO 130 lbs.-in.
USE LOCTITE ON THREADS.



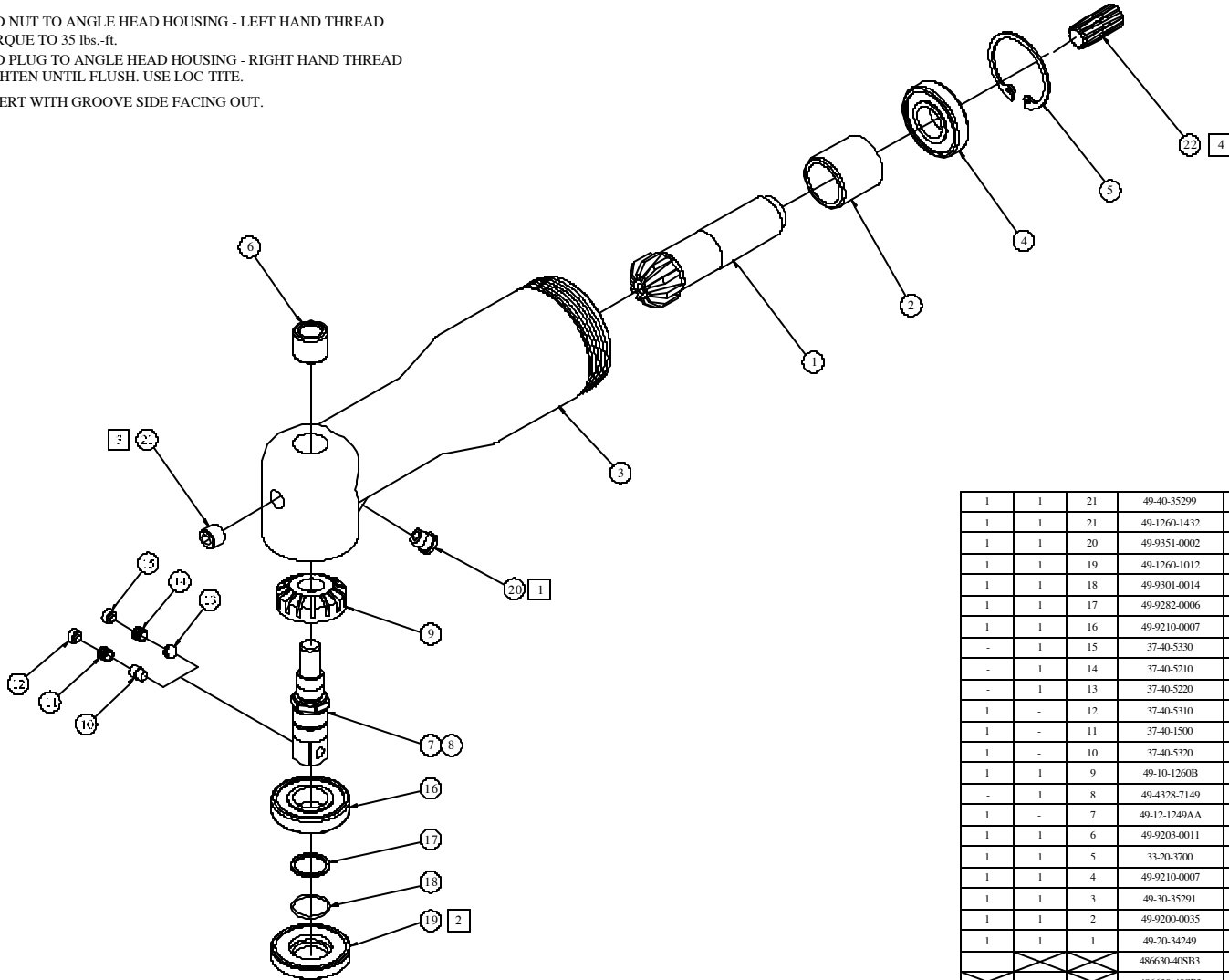
1	1	16	49-1260-1432	SET SCREW, 1/16-27x1/4
1	1	15	49-9351-0001	GREASE FITTING
1	1	14	49-5701-8140	END NUT, R/A HEAD
1	1	13	49-9301-0015	O-RING
1	1	12	49-9210-0092A	BEARING, BALL
1	-	11	43-30-2001	QUICK RELEASE CHUCK, 7/16"
-	1	10	43-30-2000	QUICK RELEASE CHUCK, 1/4"
1	1	9	49-9319-0025	RETAINING NUT, OUTPUT SHAFT
1	1	8	49-20-26994	OUTPUT SHAFT, R/A, QUICK CHUCK
1	1	7	49-10-26676	BEVEL GEAR (12T)
1	1	6	49-9201-0006	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	5	33-20-1400	RETAINING RING, INTERNAL
1	1	4	49-9210-0006	BEARING, BALL
1	1	3	49-30-35290	HEAD HOUSING, RIGHT ANGLE
1	1	2	49-9200-0024	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	1	49-20-34212	C, INPUT SHAFT, 66 SERIES
			486630-25Q025	R/A HEAD ASSY 1/4" QUICK CHUCK
			486630-25Q438	R/A HEAD ASSY 7/16" QUICK CHUCK
QTY REQD	ITEM NO.	PART NO.	DESCRIPTION/MATERIAL	

BILL OF MATERIAL

40 Nm RIGHT ANGLE HEAD ASSEMBLY

NOTES:

- 1 LUBRICATE BEVEL GEAR & INPUT SHAFT WITH MOBILITH SHC 460 (42-90-0102).
- 2 END NUT TO ANGLE HEAD HOUSING - LEFT HAND THREAD
TORQUE TO 35 lbs.-ft.
- 3 END PLUG TO ANGLE HEAD HOUSING - RIGHT HAND THREAD
TIGHTEN UNTIL FLUSH. USE LOC-TITE.
- 4 INSERT WITH GROOVE SIDE FACING OUT.

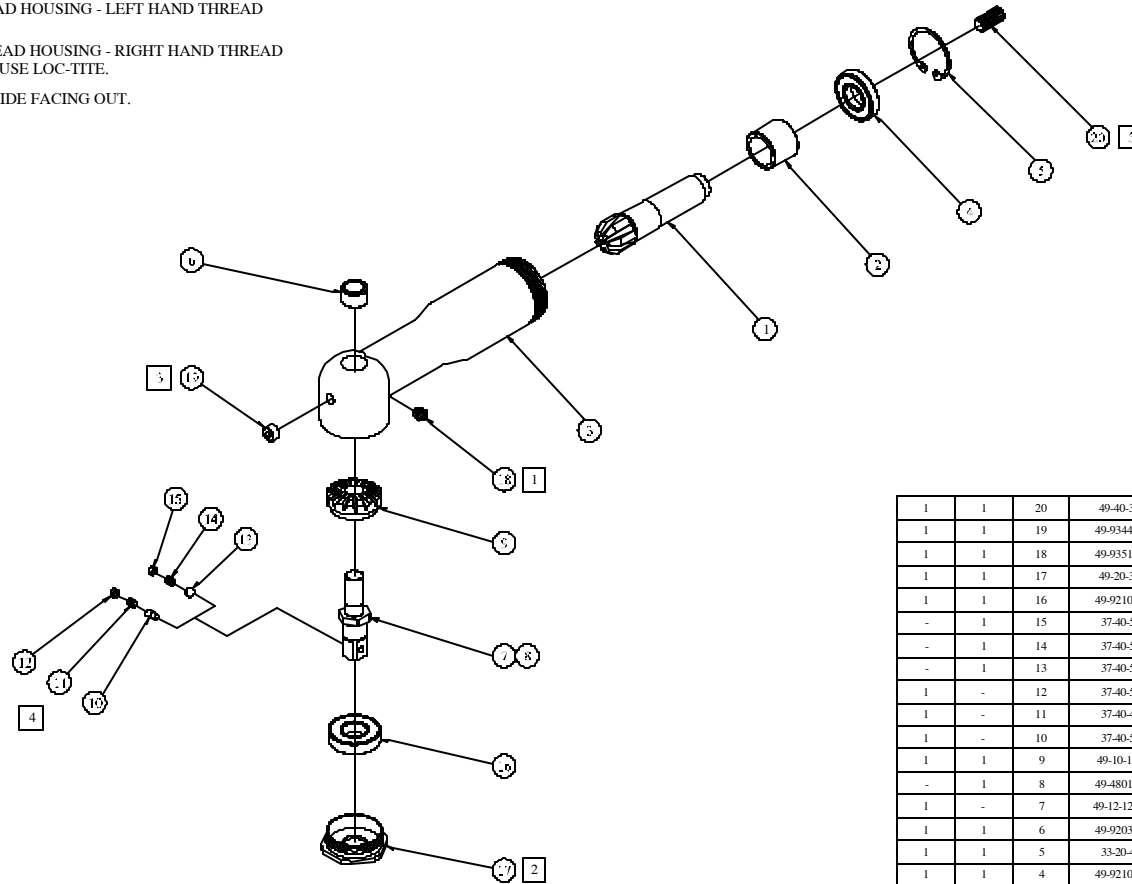


1	1	21	49-40-35299	ADAPTER, SPLINE, MALE/MALE
1	1	21	49-1260-1432	SET SCREW, 1/16-27x1/4 P.T.
1	1	20	49-9351-0002	FITTING, GREASE
1	1	19	49-1260-1012	END NUT - RIGHT ANGLE
1	1	18	49-9301-0014	O-RING
1	1	17	49-9282-0006	RETAINING RING
1	1	16	49-9210-0007	BEARING, BALL
-	1	15	37-40-5330	PLUG - 3/8" DRIVE, BALL
-	1	14	37-40-5210	SPRING - 3/8" DRIVE, BALL
-	1	13	37-40-5220	BALL, 3/16" DIA. - 3/8" DRIVE
1	-	12	37-40-5310	PLUG - 3/8" DRIVE, PIN
1	-	11	37-40-1500	SPRING - 3/8" DRIVE, PIN
1	-	10	37-40-5320	PIN, 3/8" DRIVE
1	1	9	49-10-1260B	BEVEL GEAR
-	1	8	49-4328-7149	SHAFT, OUTPUT, BALL
1	-	7	49-12-1249AA	SHAFT, OUTPUT, PIN
1	1	6	49-9203-0011	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	5	33-20-3700	RETAINING RING, INTERNAL
1	1	4	49-9210-0007	BEARING, BALL
1	1	3	49-30-35291	HOUSING, HEAD, RIGHT ANGLE
1	1	2	49-9200-0035	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	1	49-20-34249	SHAFT, INPUT - 66 SERIES
			486630-40SB3	HEAD ASSY, RIGHT ANGLE - BALL
			486630-40SP3	HEAD ASSY, RIGHT ANGLE - PIN
QTY REQD	ITEM NO.	PART NO.	DESCRIPTION/MATERIAL	
BILL OF MATERIAL				

75 & 90 Nm RIGHT ANGLE HEAD ASSEMBLY

NOTES:

- 1 LUBRICATE BEVEL GEAR & INPUT SHAFT WITH MOBILITH SHC 460 (42-90-0102).
- 2 END NUT TO ANGLE HEAD HOUSING - LEFT HAND THREAD
TORQUE TO 35 lbs.-ft.
- 3 END PLUG TO ANGLE HEAD HOUSING - RIGHT HAND THREAD
TIGHTEN UNTIL FLUSH. USE LOC-TITE.
- 4 INSERT WITH GROOVE SIDE FACING OUT.

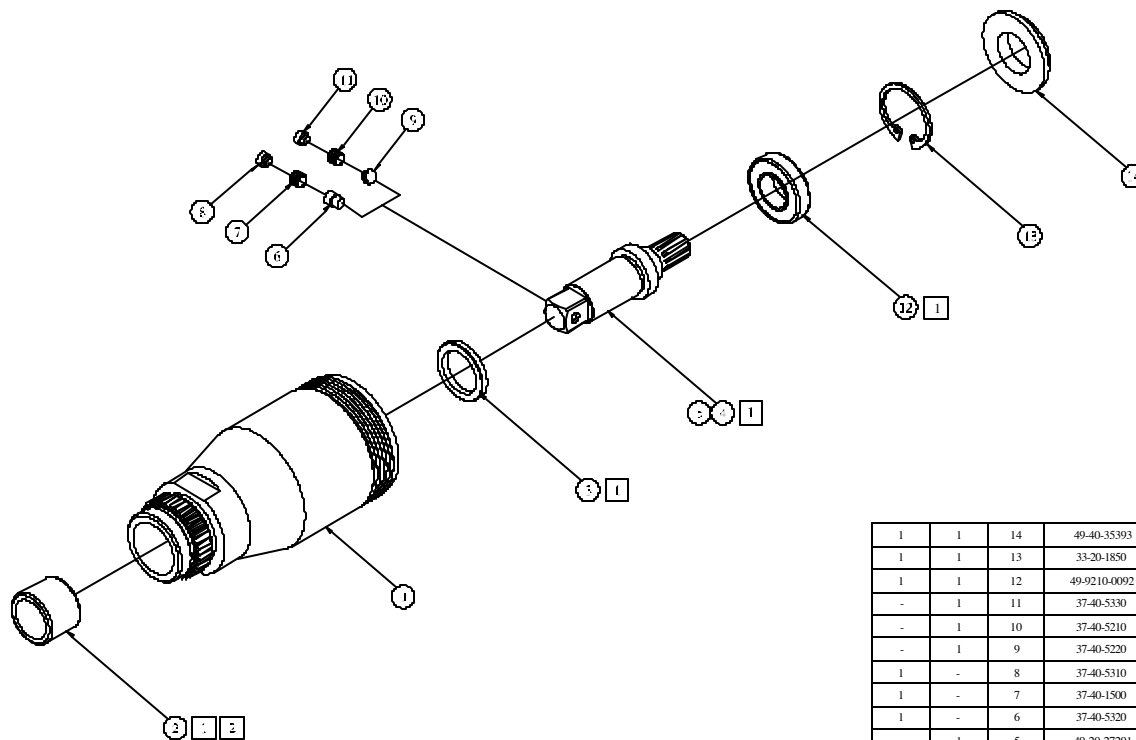


1	1	20	49-40-35299	B, SPLINE ADAPTER
1	1	19	49-9344-0006	1/8-27x1/4 P.T. HX-S, SP F FT
1	1	18	49-9351-0002	#1885, GREASE FITTING
1	1	17	49-20-35539	HEX END NUT
1	1	16	49-9210-0011	RIODDU NSK BALL BRG
-	1	15	37-40-5469	HP-278-S-62 PLUG
-	1	14	37-40-5380	#LC035C-5 MUSIC WIRE SPRING
-	1	13	37-40-5200	1/4" DIA. BALL
1	-	12	37-40-5330	R-16 PLUG
1	-	11	37-40-4000	#LC018B-1 MUSIC WIRE SPRING
1	-	10	37-40-5340	R-17 PIN
1	1	9	49-10-1260A	BEVEL GEAR
-	1	8	49-4801-7231	C, OUTPUT SHAFT, BALL
1	-	7	49-12-1249AE	C, OUTPUT SHAFT, PIN
1	1	6	49-9203-0051	M-881 TORR. BEARING CLS END
1	1	5	33-20-4200	NS002-137, TRUARC, INT SNAP RING
1	1	4	49-9210-0010	FAFNIR 57K BALL BRG
1	1	3	49-30-35292	D, HEAD HOUSING MACH. DETAIL
1	1	2	49-9202-0046	28208A, B-1314 NEEDLE BRG
1	1	1	49-20-34250	C, INPUT SHAFT, 66 SERIES
			486630-90SB4	35318C, R/A HD. ASSY. 1/2" DR BALL
			486630-90SP4	35318C, R/A HD. ASSY. 1/2" DR PIN
QTY REQ'D	ITEM NO.	PART NO.	DESCRIPTION/MATERIAL	
BILL OF MATERIAL				

20 Nm DOUBLE STAGE INLINE HEAD ASSEMBLY

NOTES:

- 1 LUBRICATE WITH MOBILITH SHC 460 (GSE #42-90-0102).
- 2 BEARING TO BE INSTALLED WITH O-RING FACING OUTWARD.

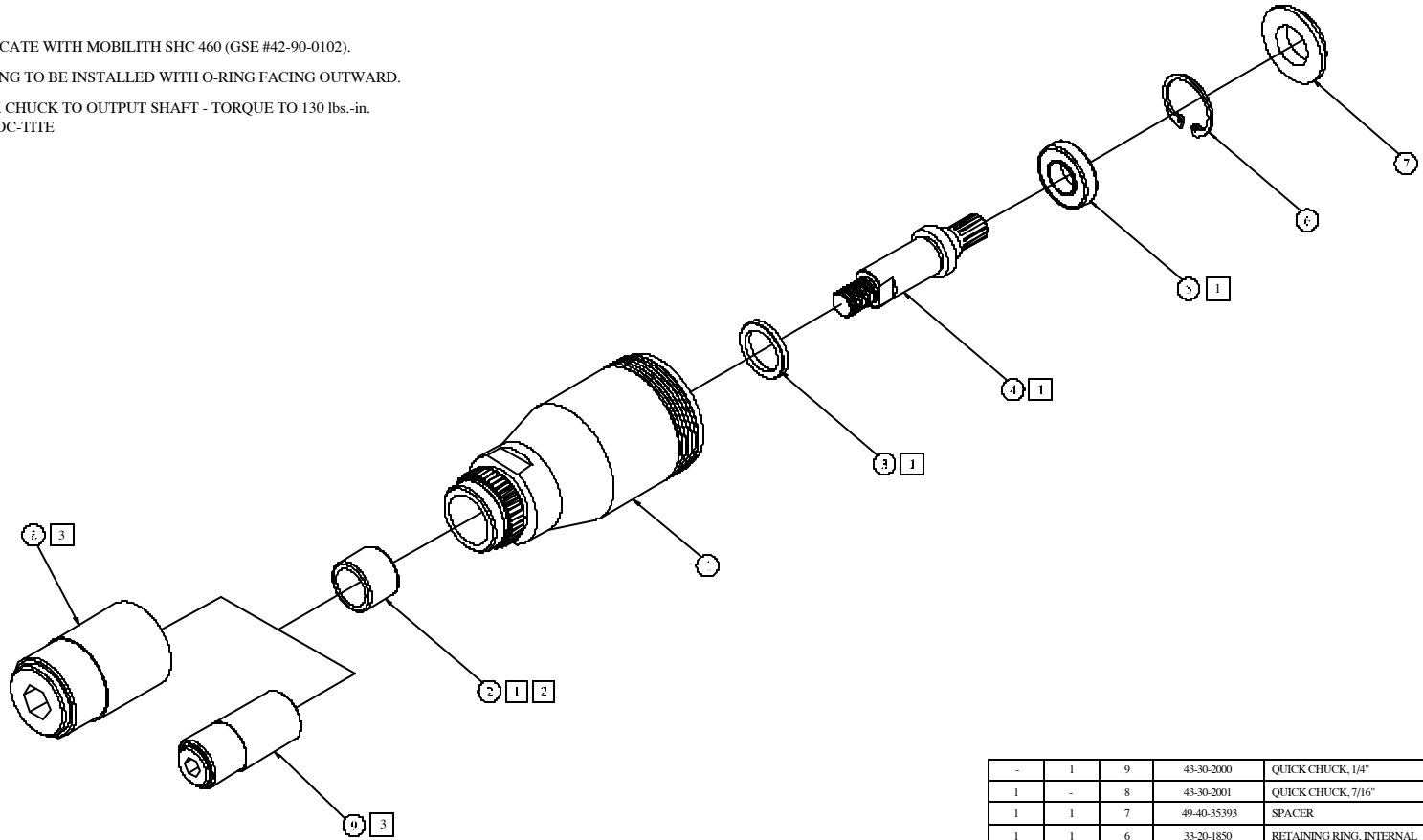


1	1	14	49-40-35393	SPACER
1	1	13	33-20-1850	RETAINING RING, INTERNAL
1	1	12	49-9210-0092	BEARING, BALL
-	1	11	37-40-5330	PLUG - 3/8" DRIVE, BALL
-	1	10	37-40-5210	SPRING - 3/8" DRIVE, BALL
-	1	9	37-40-5220	BALL, 3/16" DIA. - 3/8" DRIVE
1	-	8	37-40-5310	PLUG - 3/8" DRIVE, PIN
1	-	7	37-40-1500	SPRING - 3/8" DRIVE, PIN
1	-	6	37-40-5320	PIN - 3/8" DRIVE
-	1	5	49-20-27291	SPINDLE, INLINE - 3/8" DRIVE, BALL
1	-	4	49-5803-7102	SPINDLE, INLINE - 3/8" DRIVE, PIN
1	1	3	49-5803-8101	WASHER
1	1	2	49-9222-0016	BEARING, DRAWN DUP NEEDLE ROLLER
1	1	1	49-40-35392	HOUSING, HEAD, INLINE
			486630-B2375	HEAD ASSY, INLINE - BALL
			486630-P2375	HEAD ASSY, INLINE - PIN
QTY REQ'D	ITEM NO.	PART NO.	DESCRIPTION/MATERIAL	
BILL OF MATERIAL				

20 Nm QUICK CHUCK DOUBLE STAGE INLINE HEAD ASSEMBLY

NOTES:

- 1 LUBRICATE WITH MOBILITH SHC 460 (GSE #42-90-0102).
- 2 BEARING TO BE INSTALLED WITH O-RING FACING OUTWARD.
- 3 QUICK CHUCK TO OUTPUT SHAFT - TORQUE TO 130 lbs.-in. USE LOC-TITE

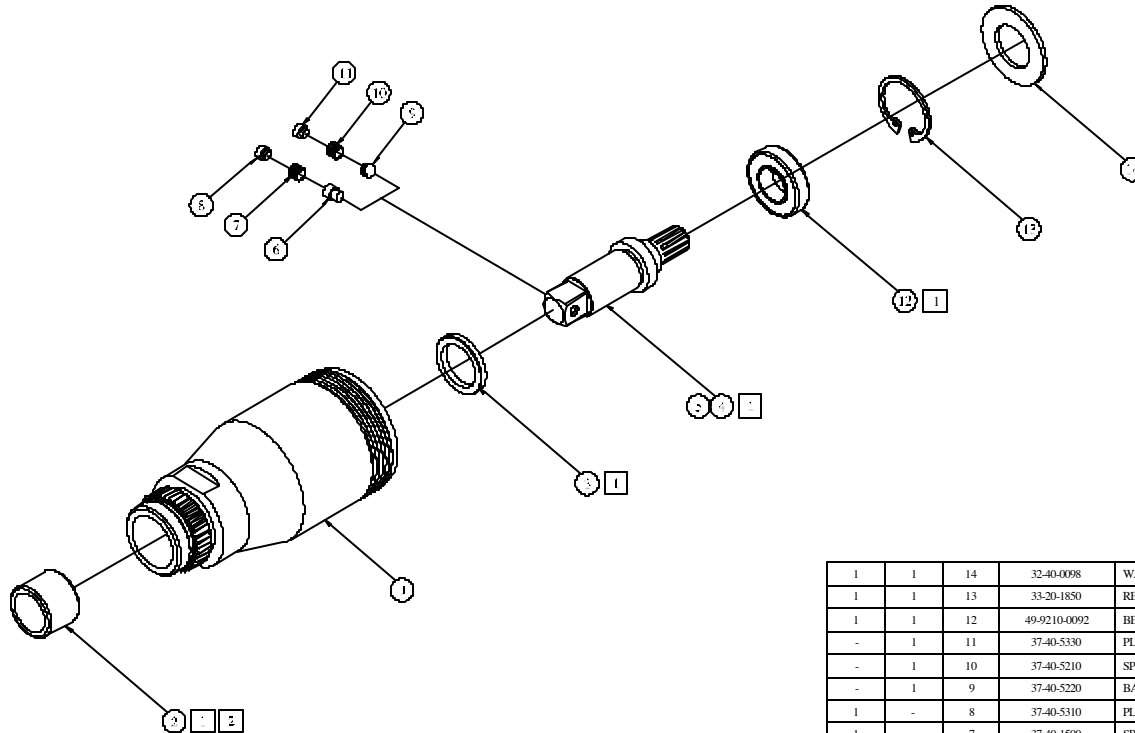


-	1	9	43-30-2000	QUICK CHUCK, 1/4"
1	-	8	43-30-2001	QUICK CHUCK, 7/16"
1	1	7	49-40-35393	SPACER
1	1	6	33-20-1850	RETAINING RING, INTERNAL
1	1	5	49-9210-0092	BEARING, BALL
1	1	4	49-20-28538	OUTPUT SPINDLE, HEX DRIVE
1	1	3	49-5803-8101	WASHER
1	1	2	49-9222-0016	BEARING, DRAWN CUP NEEDLE
1	1	1	49-40-35392	HEAD HOUSING, INLINE, 20 Nm
X	X	X	486630-Q2025	INLINE HEAD ASSY 1/4" QUICK CHUCK
X	X	X	486630-Q20438	INLINE HEAD ASSY 7/16" QUICK CHUCK
QTY REQ'D	ITEM NO.	PART NO.	DESCRIPTION/MATERIAL	
BILL OF MATERIAL				

30-40 Nm DOUBLE STAGE INLINE HEAD ASSEMBLY

NOTES:

- 1 LUBRICATE WITH MOBILITH SHC 460 (GSE #42-90-0102).
- 2 BEARING TO BE INSTALLED WITH O-RING FACING OUTWARD.

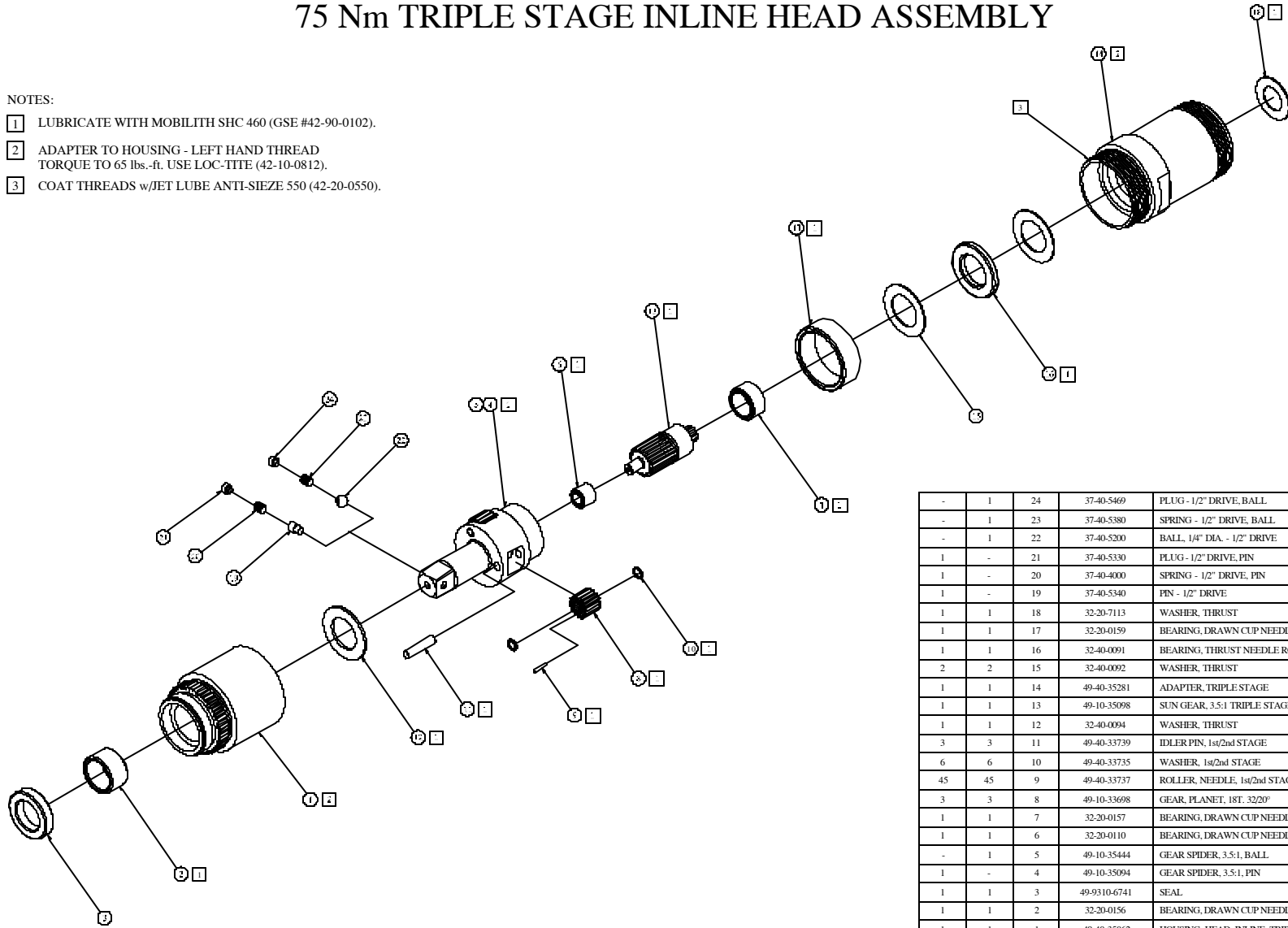


1	1	14	32-40-0098	WASHER, THRUST
1	1	13	33-20-1850	RETAINING RING, INTERNAL
1	1	12	49-9210-0092	BEARING, BALL
-	1	11	37-40-5330	PLUG - 3/8" DRIVE, BALL
-	1	10	37-40-5210	SPRING - 3/8" DRIVE, BALL
-	1	9	37-40-5220	BALL, 3/16" DIA. - 3/8" DRIVE
1	-	8	37-40-5310	PLUG - 3/8" DRIVE, PIN
1	-	7	37-40-1500	SPRING - 3/8" DRIVE, PIN
1	-	6	37-40-5320	PIN - 3/8" DRIVE
-	1	5	49-20-27291	SPINDLE, INLINE - 3/8" DRIVE, BALL
1	-	4	49-5803-7102	SPINDLE, INLINE - 3/8" DRIVE, PIN
1	1	3	49-5803-8101	WASHER
1	1	2	49-9222-0016	BEARING, DRAWN CUP NEEDLE BEARING
1	1	1	49-40-35280	HOUSING, HEAD, INLINE
			486630-B1375	HEAD ASSY, INLINE - BALL
			486630-P1375	HEAD ASSY, INLINE - PIN
QTY REQ'D	ITEM NO.	PART NO.	DESCRIPTION/MATERIAL	
BILL OF MATERIAL				

75 Nm TRIPLE STAGE INLINE HEAD ASSEMBLY

NOTES:

- 1 LUBRICATE WITH MOBILITH SHC 460 (GSE #42-90-0102).
- 2 ADAPTER TO HOUSING - LEFT HAND THREAD
TORQUE TO 65 lbs.-ft. USE LOC-TITE (42-10-0812).
- 3 COAT THREADS w/JET LUBE ANTI-SIEZE 550 (42-20-0550).



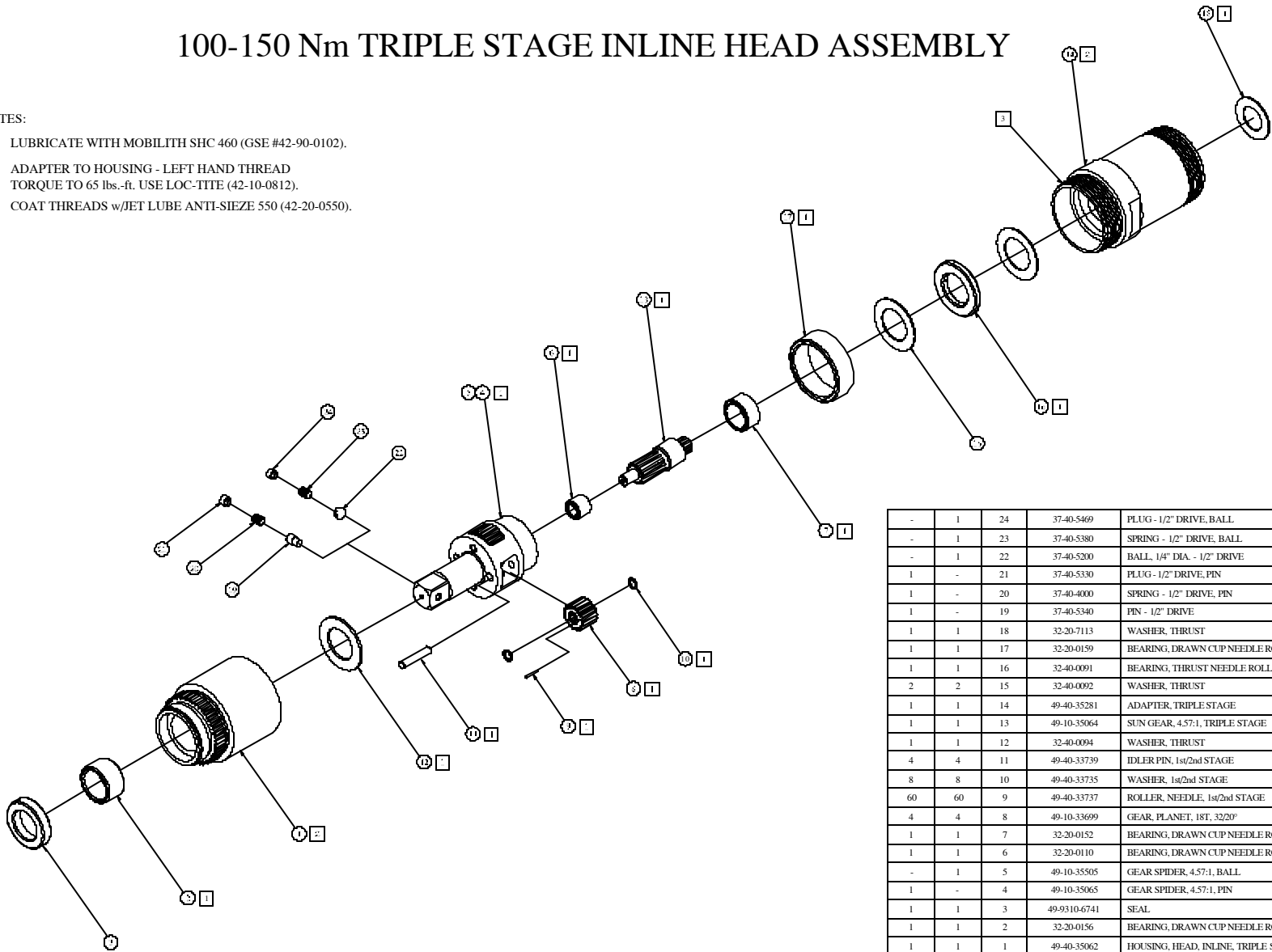
-	1	24	37-40-5469	PLUG - 1/2" DRIVE, BALL
-	1	23	37-40-5380	SPRING - 1/2" DRIVE, BALL
-	1	22	37-40-5200	BALL, 1/4" DIA. - 1/2" DRIVE
1	-	21	37-40-5330	PLUG - 1/2" DRIVE, PIN
1	-	20	37-40-4000	SPRING - 1/2" DRIVE, PIN
1	-	19	37-40-5340	PIN - 1/2" DRIVE
1	1	18	32-20-7113	WASHER, THRUST
1	1	17	32-20-0159	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	16	32-40-0091	BEARING, THRUST NEEDLE ROLLER
2	2	15	32-40-0092	WASHER, THRUST
1	1	14	49-40-35281	ADAPTER, TRIPLE STAGE
1	1	13	49-10-35098	SUN GEAR, 3.5:1 TRIPLE STAGE
1	1	12	32-40-0094	WASHER, THRUST
3	3	11	49-40-33739	IDLER PIN, 1st/2nd STAGE
6	6	10	49-40-33735	WASHER, 1st/2nd STAGE
45	45	9	49-40-33737	ROLLER, NEEDLE, 1st/2nd STAGE
3	3	8	49-10-33698	GEAR, PLANET, 18T, 32/20°
1	1	7	32-20-0157	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	6	32-20-0110	BEARING, DRAWN CUP NEEDLE ROLLER
-	1	5	49-10-35444	GEAR SPIDER, 3.5:1, BALL
1	-	4	49-10-35094	GEAR SPIDER, 3.5:1, PIN
1	1	3	49-9310-6741	SEAL
1	1	2	32-20-0156	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	1	49-40-35062	HOUSING, HEAD, INLINE, TRIPLE STAGE
			486630-B1135	HEAD ASSEMBLY, INLINE, 3.5:1, BALL
			486630-P1135	HEAD ASSEMBLY, INLINE, 3.5:1, PIN
QTY REQ'D	ITEM NO.	PART NO.	DESCRIPTION/MATERIAL	

BILL OF MATERIAL

100-150 Nm TRIPLE STAGE INLINE HEAD ASSEMBLY

NOTES:

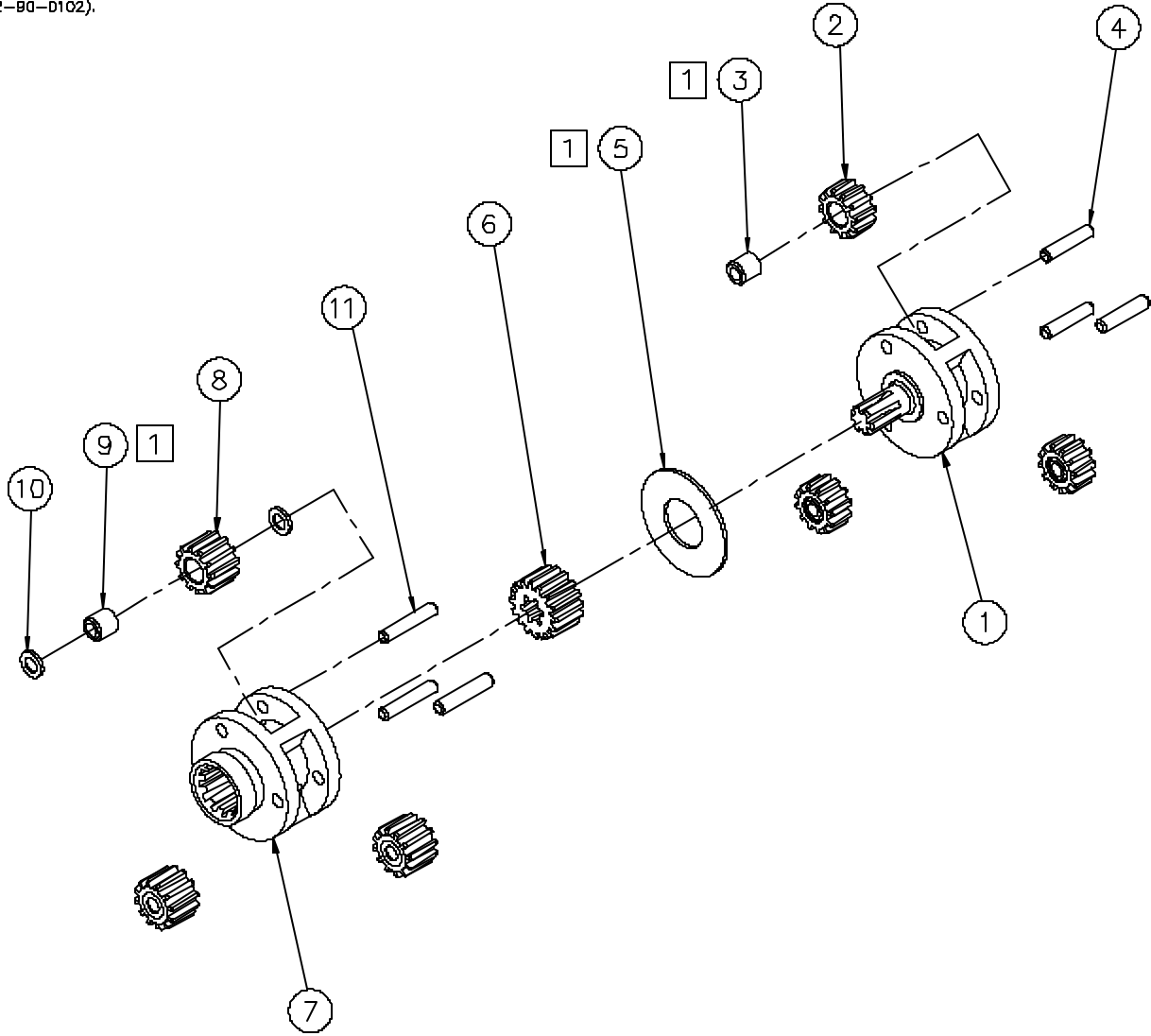
- 1 LUBRICATE WITH MOBILITH SHC 460 (GSE #42-90-0102).
- 2 ADAPTER TO HOUSING - LEFT HAND THREAD
TORQUE TO 65 lbs.-ft. USE LOC-TITE (42-10-0812).
- 3 COAT THREADS w/JET LUBE ANTI-SIEZE 550 (42-20-0550).



-	1	24	37-40-5469	PLUG - 1/2" DRIVE, BALL
-	1	23	37-40-5380	SPRING - 1/2" DRIVE, BALL
-	1	22	37-40-5200	BALL, 1/4" DIA. - 1/2" DRIVE
1	-	21	37-40-5330	PLUG - 1/2" DRIVE, PIN
1	-	20	37-40-4000	SPRING - 1/2" DRIVE, PIN
1	-	19	37-40-5340	PIN - 1/2" DRIVE
1	1	18	32-20-7113	WASHER, THRUST
1	1	17	32-20-0159	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	16	32-40-0091	BEARING, THRUST NEEDLE ROLLER
2	2	15	32-40-0092	WASHER, THRUST
1	1	14	49-40-35281	ADAPTER, TRIPLE STAGE
1	1	13	49-10-35064	SUN GEAR, 4.57:1, TRIPLE STAGE
1	1	12	32-40-0094	WASHER, THRUST
4	4	11	49-40-33739	IDLER PIN, 1st/2nd STAGE
8	8	10	49-40-33735	WASHER, 1st/2nd STAGE
60	60	9	49-40-33737	ROLLER, NEEDLE, 1st/2nd STAGE
4	4	8	49-10-33699	GEAR, PLANET, 18T, 32/20°
1	1	7	32-20-0152	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	6	32-20-0110	BEARING, DRAWN CUP NEEDLE ROLLER
-	1	5	49-10-35505	GEAR SPIDER, 4.57:1, BALL
1	-	4	49-10-35065	GEAR SPIDER, 4.57:1, PIN
1	1	3	49-9310-6741	SEAL
1	1	2	32-20-0156	BEARING, DRAWN CUP NEEDLE ROLLER
1	1	1	49-40-35062	HOUSING, HEAD, INLINE, TRIPLE STAGE
			486630-B1145	HEAD ASSEMBLY, INLINE, 4.57:1, BALL
			486630-P1145	HEAD ASSEMBLY, INLINE, 4.57:1, PIN
QTY REQ'D	ITEM NO.	PART NO.	DESCRIPTION/MATERIAL	
BILL OF MATERIAL				

NOTE:

- 1 LUBRICATE NEEDLE BEARINGS & WASHER BEFORE ASSEMBLY WITH MOBILITH SHC 460 (42-90-0102).
- 2. AFTER ASSEMBLING, COAT WITH MOBILITH SHC 460 (42-90-0102).

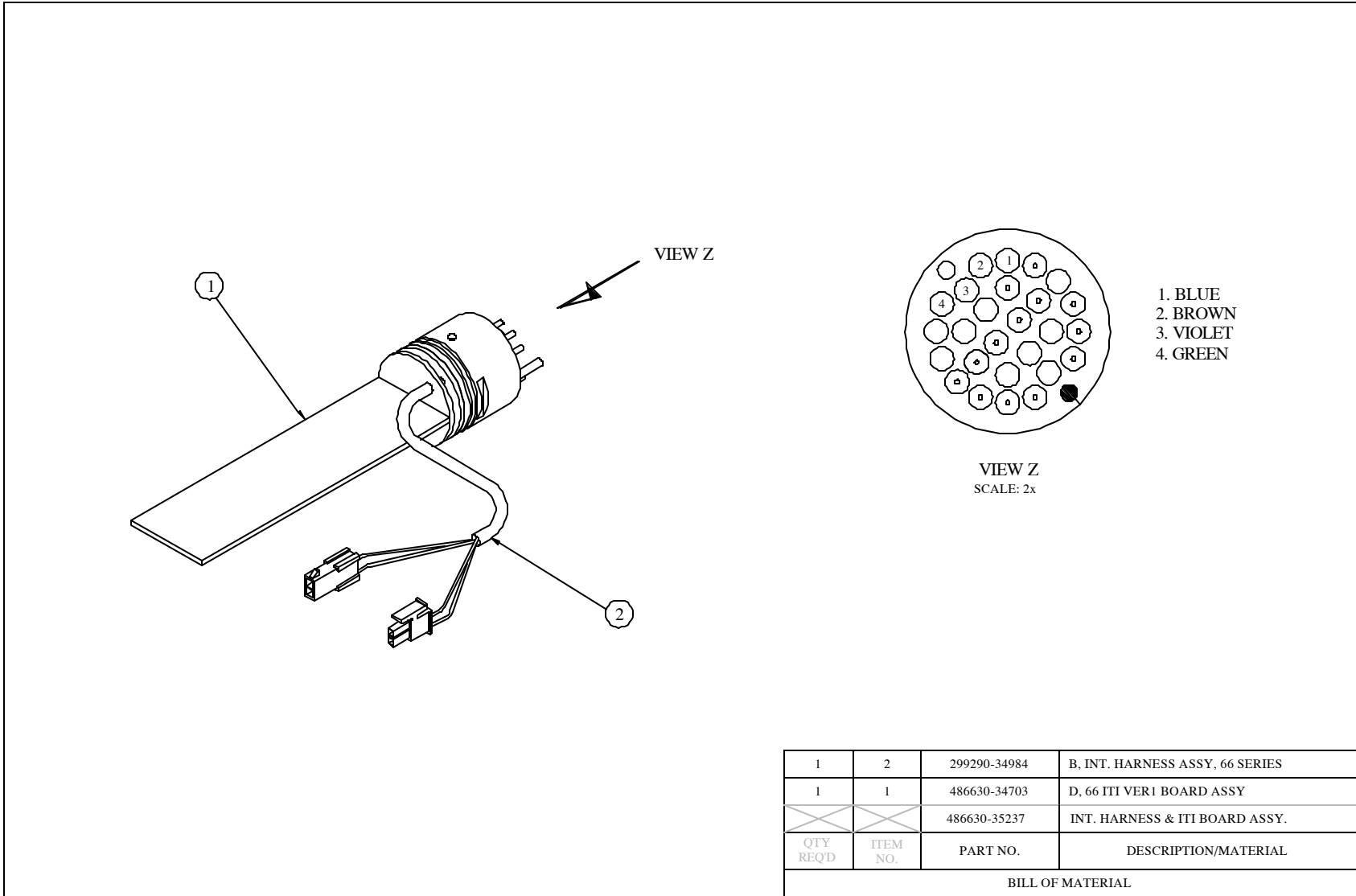


GEAR CASE ASSEMBLY BILL of MATERIAL

-	3	3	3	11	49-40-342893	IDLER PIN, 2nd STAGE
3	-	-	-	11	49-40-342892	IDLER PIN, 2nd STAGE
6	-	-	-	10	49-50-6070	SPACER
-	3	3	3	9	32-20-0065	BEARING, CAGE, NEEDLE
3	-	-	-	9	32-20-0050	BEARING, CAGE, NEEDLE
-	-	3	3	8	49-10-34235	GEAR, PLANET, 2nd STAGE
-	3	-	-	8	49-10-34234	GEAR, PLANET, 2nd STAGE
3	-	-	-	8	49-10-34244	GEAR, PLANET, 2nd STAGE
-	-	1	1	7	49-10-34263	GEAR SPIDER, 2nd STAGE
-	1	-	-	7	49-10-34254	GEAR SPIDER, 2nd STAGE
1	-	-	-	7	49-10-34265	GEAR SPIDER, 2nd STAGE
-	-	-	-	6	49-10-34292	GEAR, SUN, 2nd STAGE
1	1	1	1	5	32-20-7112	WASHER, THRUST
-	3	3	3	4	49-40-342894	IDLER PIN, 1st STAGE
3	-	-	-	4	49-40-342891	IDLER PIN, 1st STAGE
-	3	3	3	3	32-20-0060	BEARING, CAGE, NEEDLE
3	-	-	-	3	32-20-0050	BEARING, CAGE, NEEDLE
-	-	-	3	2	49-10-34236	GEAR, PLANET, 1st STAGE
-	3	3	-	2	49-10-34241	GEAR, PLANET, 1st STAGE
3	-	-	-	2	49-10-34243	GEAR, PLANET, 1st STAGE
-	-	-	1	1	49-10-34262	GEAR SPIDER, 1st STAGE
-	-	1	-	1	49-10-34975	GEAR SPIDER, 1st STAGE
-	1	-	-	1	49-10-34255	GEAR SPIDER, 1st STAGE
1	-	-	-	1	49-10-34264	GEAR SPIDER, 1st STAGE
			X	X	483066-0032	GEAR CASE ASSEMBLY, 32:1
		X	X	X	483066-0025	GEAR CASE ASSEMBLY, 25:1
	X	X	X	X	483066-0020	GEAR CASE ASSEMBLY, 20:1
X	X	X	X	X	483066-0013	GEAR CASE ASSEMBLY, 13:1
QTY REQ'D				ITEM NO.	PART NO.	DESCRIPTION/MATERIAL
BILL OF MATERIAL						

2	6	38-28-8450	8-32x1/4, LOW HD, CAP, HX-S
1	5	49-70-35350	C, THROTTLE LEVER, SHORT
1	4	483056-33733	PARAMETER SET BUTTON CARTRIDGE
1	3	483056-33696	THROTTLE BUTTON CARTRIDGE ASSY
1	2	38-28-5290	W26A, REID, BALL PLINGER
1	1	485410-28667	B, REV. SLIDE PIN/MAGNET ASSY
X	X	483066-S	THROTTLE KIT, T066 SERIES
QTY REQ'D	ITEM NO.	PART NO.	DESCRIPTION/MATERIAL

BILL OF MATERIAL



Part Number 39-30-35873



E-mail: aagsales@ait-udi.com
Website: www.aagtools.com

Product Development Center
23640 Research Drive
Farmington Hills, MI
48335-2621 USA

Phone: (248) 476-7875
Toll free: (800) 795-7875
FAX: (248) 473-7699

Systems Technical Center
2889 Bond Street
Rochester Hills, MI
48309-3515 USA

Phone: (248) 852-3500
Toll free: (888)-781-0123
FAX: (248) 844-0844

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