Technical Bulletin		
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HXI Top Drive Operation is Modified with New PLC Code		

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BACKGROUND:

Within the last few years, the PLC program for TESCO HXI Top Drive units has been modified to improve operation and performance. The documentation, however, has not yet been updated to reflect the modified operation. Some of the changes were a result of HAZOP reviews.

THE PROBLEM:

Recently, when new code has been installed in the field as an upgrade, rig personnel have attempted to operate the unit as they had previously or as per the HXI Top Drive Operations Guide, and the unit would not function properly.

ANALYSIS:

When new PLC code is used (version Code_PLC_HXI_228_NCP_Rev2 or later and version Code_PLC_HXI_228_NCP_Rev1 or earlier), the steps outlined in the "Action Required" section of this document must be followed.

AFFECTED PRODUCTS:

All PLC-operated HXI Top Drive units are affected (when the updated code is installed in the PLC).

ACTION REQUIRED:

Perform the following steps after the updated HXI PLC code has been installed:

1. Wire the ESD Status back to the PLC. See schematics 9107C112, 9107C208 and 9107C212 for details. If the ESD is activated, Current Speed is zeroed and all Drill Speed settings are zeroed.
2. Perform the Drill Low Auto-Tune procedure. This allows the PLC to detect the swash required to rotate the quill at 100 rpm. If this process is not successful, default speed values are loaded into the memory. It is very important to complete the Auto-Tune successfully. If the Auto-Tune procedure fails, locate and address the problem and then perform the Auto-Tune procedure again.
3. Perform the Connect Auto-Tune procedure. This allows the PLC to detect swash needed for 14 rpm and for 30 rpm. In case of failure, default values will be loaded into memory which will provide some rotation, but the range between 14 to 30 rpm will not be accurate (e.g., the maximum rpm limit may be more than 30 rpm or may be less than 30 rpm).
4. The Auto-Tune procedure in the HXI Top Drive Operations Guide, 1570014 (Rev4 or later), must be followed. This procedure can be referenced in Appendix A.
5. Update the Auto-Tune procedure in the HXI Operations Guide to the most current revision (provided below).

Version	Date (D/M/Y)	ECN	Description of Bulletin Changes
Rev 0	13/12/2012	136-0036	Initial release of document

Other upgrades include the following:

- Connect Speed can now be adjusted between 14 to 30 rpm while connection is being made. It is typically +/- 2 rpm of the given range.
- Breakout Speed can also be adjusted from 14 to 30 rpm while breaking out. It may require a speed of approximately 17 rpm to achieve full breakout.
- Hot oil shuttle valve operation has been changed to prevent over-speed conditions when neutral is selected.
- Engine rpm ramps down to 1,000 rpm three seconds after switching to Connect mode.
- The mudsaver valve does not operate until the speed is zero. This is in PLC code version Rev2D or later.

Important Note: The Auto-Tune process for earlier versions of the PLC code differs from Rev2. See the HXI Top Drive Operations Guide for details.

Auto-Tune Process for PLC Code "Code_PLC_HXI_228_NCP_Rev2" or Later

If the top drive is not rotating at correct maximum speed, an Auto-Tune may be necessary. The Auto-Tune feature calibrates the swash controller to the pumps, which in turn will provide the output flow necessary to turn the top drive motor at correct maximum speed.

1. From the HXI Top Drive driller's panel (Figure 1), set the MODE switch to 'DRILL LO' and QUILL switch to the middle (neutral) position.
2. Turn the SET/OFF/RUN switch to 'SET' and press the MAX TORQUE button simultaneously until the 'READY' light begins to flash.

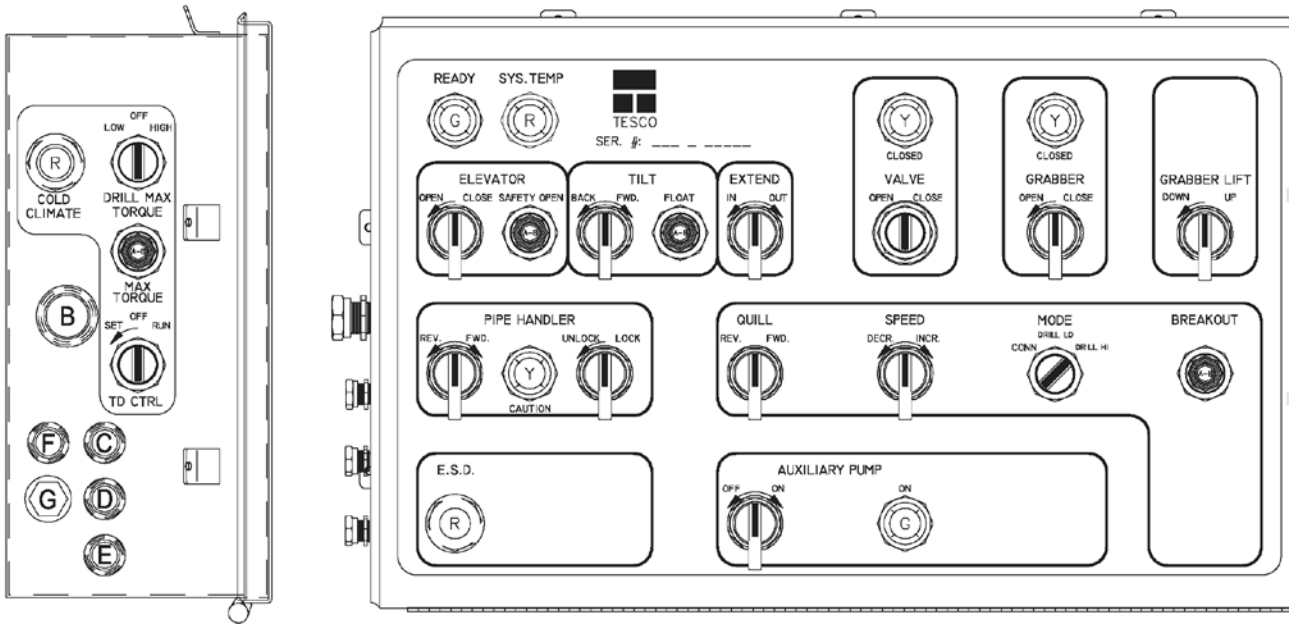

Figure 1: HXI driller's panel

3. Wait 2 seconds and turn the SET/OFF/RUN switch to 'RUN'. Press and hold the MAX TORQUE push button down until Auto-Tune process is complete. Releasing the MAX TORQUE button will stop the Auto-Tune procedure. If this occurs, go to step 2 and restart.

   Note: For PLC code "Rev1" or earlier, the MAX TORQUE button can be released after the SET/OFF/RUN switch is set to 'RUN'.

4. The Auto-Tune will begin by slowly ramping up the swash until the quill reaches 1 rpm. This will take 15 to 30 seconds.
5. After the quill reaches 1 rpm and stabilizes, the quill will ramp up slowly to 100 rpm without over-shooting.

   Note: For PLC code "Rev1" or earlier, the quill will ramp up to a speed above 100 rpm (about 127 rpm) and slowly reduce back down to 100 rpm. This over-shoot is due to fast ramp.
6. The quill will then stop, and the 'READY' light will become solid indicating a successful Auto-Tune.
7. If the quill fails to reach the above speeds for any reason, the Auto-Tune will fail after 2-1/2 minutes (2 minutes for PLC code "Rev1" or earlier), indicated by rapid flashing of the 'READY' light for 10 seconds.
8. If Auto-Tune fails, the swash controller will revert to full scale control allowing the top drive to rotate, but with less accurate control.

Connect Auto-Tune:

1. From the driller's panel, set the MODE switch to 'CONN' (Connect Mode) and the QUILL direction switch to neutral (similar to the Drill Low Auto-Tune procedure).

   Note: For PLC code "Rev1" or earlier, set the QUILL direction switch to 'FWD'.
2. Turn the SET/OFF/RUN switch to 'SET' and press the MAX TORQUE button simultaneously until the 'READY' light begins to flash.
3. Wait 2 seconds and turn the SET/OFF/RUN switch to 'RUN'. Keep the MAX TORQUE button pressed down until the process is complete (the 'READY' light becomes solid or flashes rapidly). Releasing the MAX TORQUE button will stop the Auto-Tune procedure. If this occurs, go to step 2 and restart.

   Note: For PLC code "Rev1" or earlier, Max TORQUE button can be released when SET/OFF/RUN switch is set to 'RUN'.
4. Speed will ramp up to 14 rpm and then stop. Speed will then ramp up to 30 rpm and stop. At this time, the 'READY' light will stop flashing and become solid.

   Note: This procedure may take up to 2 minutes to complete due to the slow increase in ramps.
5. If 14 rpm or 30 rpm is not reached within 2-1/2 minutes (3 minutes for PLC code "Rev1" or earlier), the Auto-Tune process will fail. The 'READY' light will flash rapidly for 10 seconds. This will then load default values for 14 rpm and 30 rpm which may not be accurate to give 14 or 30 rpm speed but it will provide some rotation.

APPENDIX A:

NOTE: Auto-Tune is a calibration tool only and does not set the quill rotational speeds. The operator must still set CONNECT, DRILL and BREAKOUT speed.

SETTING CONNECT SPEEDS

After performing a successful Auto-Tune, connect and breakout speeds will be at a default setting of 14 rpm (±2 rpm). Connect and breakout speeds are now fully adjustable between 14 and 30 rpm.

Procedure to Adjust Connect-Forward Speed

1. On the driller's panel move the MODE switch to the 'CONN' position and the QUILL switch to 'FWD'.
2. Ensure the TD CTRL switch is in the 'RUN' position. The quill should now be rotating forward at 14 rpm (±2).
3. Move the SPEED switch to the 'INCR' position and hold until the desired connect speed is reached (ideally 18 to 20 rpm).
4. Move the SPEED switch to the neutral position. The quill should be rotating at 18 to 20 rpm.
5. Move the QUILL switch to the neutral position.

The connect-forward speed is now set. The PLC will retain this setting until electrical power is removed. Use the above procedure to reset connect-forward speed when power is restored.

Procedure to Adjust Connect-Reverse Speed

1. On the driller's panel move the MODE switch to the 'CONN' position and the QUILL switch to 'REV'.
2. Ensure the TD CTRL switch is in the 'RUN' position. The quill should now be rotating in reverse at 14 rpm (±2).
3. Move the SPEED switch to the 'INCR' position and hold until the desired connect speed is reached (ideally 18 to 20 rpm).
4. Move the SPEED switch to the neutral position. The quill should be rotating at 18 to 20 rpm in reverse.
5. Move the QUILL switch to the neutral position.

The connect-reverse speed is now set. The PLC will retain this setting until electrical power is removed. Use the above procedure to reset connect-reverse speed when power is restored.

Procedure to Adjust Breakout Speed

1. On the driller's panel move the MODE switch to the 'CONN' position and the QUILL switch to 'REV'.
2. Ensure the TD CTRL switch is in the 'RUN' position. The quill should now be rotating in reverse at the previously set Connect-Reverse speed (18 to 20 rpm).
3. Depress the BREAKOUT pushbutton. The quill should now be rotating at 14 rpm (±2) in reverse.

4. Move the SPEED switch to the 'INCR' position and hold until the desired break-out speed is reached (ideally 16 to 18 rpm).
5. Move the SPEED switch to the neutral position. The quill should be rotating at 16 to 18 rpm in reverse.
6. Release the BREAKOUT pushbutton, the quill speed should return to the Connect-Reverse speed of 18 to 20 rpm.
7. Move the QUILL switch to the neutral position.

The breakout speed is now set. The PLC will retain this setting until electrical power is removed. Use the above procedure to reset breakout speed when power is restored. If the top drive does not consistently break connections, increase the breakout speed 1 or 2 rpm.

There are no changes to the procedures used to set drilling speeds.

Upon powering up the system, Auto-Tune only needs to be completed once. Any time an Auto-Tune is performed, any preset speeds will be reset to the default Auto-Tune speeds and it will be necessary to reset the connect and breakout speeds to the proper values. In addition, the EPROM in the PLC must be re-programmed to save the Auto-Tune parameter for future use.