



DECADE have successfully used their 260 Series Process Monitor to solve the problem of checking nut staking operations in an automotive manufacturing cell.

In the manufacture of this automotive wheel hub the drive shaft is secured to the hub assembly by a nut which is tightened up to a pre-set torque. To prevent this nut coming loose a flange on the nut is then staked into a slot in the drive shaft. The staking operation is carried out by an operator on the assembly track with a hand-held hydraulic tool. Ideally before staking the nut the operator would make sure the slot in the drive shaft was at the top so the staking tool could deform the flange into the slot. In practice however concerns has been raised as nuts had been staked out of the slot and not picked up by visual checks.

To provide a reliable method of measuring if a nut has been staked correctly DECADE decided to use a 260 Series Process Monitor and measure the hydraulic pressure and staking depth then use these two measurements to determine a pass or reject operation.

The staking tool is operated by a hydraulic cylinder triggered by the operators finger on the handle. This cylinder then operates the staking punch via a pivot mechanism.

To measure the hydraulic pressure a pressure transducer was fitted in the hydraulic supply line to the cylinder, and to measure the staking depth a short-stroke position transducer was fitted to the pivot mechanism.



X Two Nuts Staked Incorrectly. Not in the slot



✓ Nut Staked Correctly. In the centre of the slot.



Staking Tool showing the Position Transducer measuring the Stake Depth

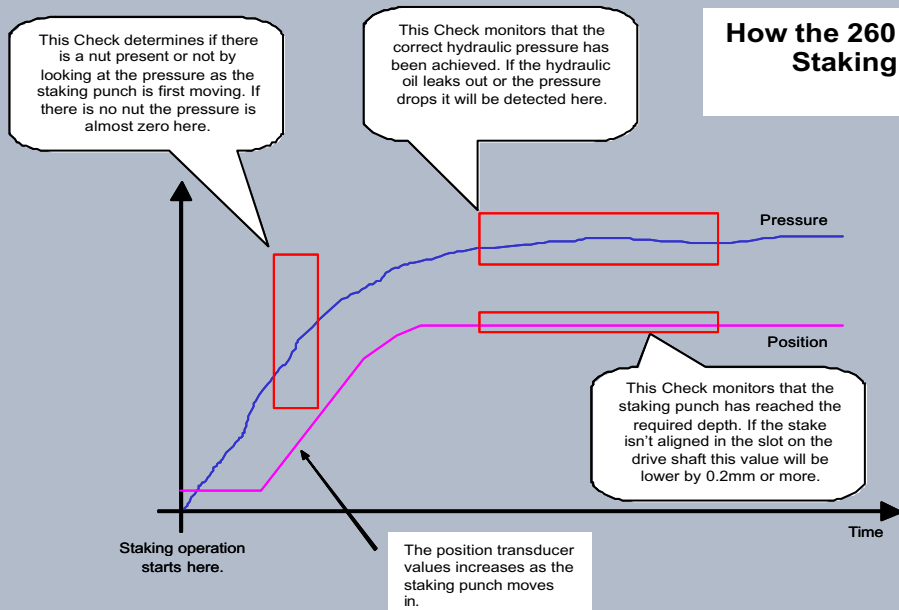
To determine if the staking operation is successful the staking tool must reach a required depth, if the tool is not aligned with the slot in the driveshaft then this depth will not be reached. Another problem is that the tool can be operated 'in the air' and to prevent this being detected as a 'good' operation the pressure is used to determine if any force has been required early-on in the stroke, i.e. to deform the nut.

When the operator operates the tool to stake a nut the 260 begins to measure the pressure and position values. By using the 260 Series versatile checking functions limits are then placed around the position and pressure values to check for a good staking operation. The 260 signals to the track PLC its status, if the process is successful a green light is displayed to the operator and the part continues down the track. If a failure is detected a red light alerts the operator and the part is held for investigation. The 260 shows process graphs and results on its colour screen, details of any failures are held in its result log.



260 Process Monitor showing pressure and position curves.

How the 260 Checks the Staking Operation..



SPC Data & Cpk Values

The 260 Series can also generate SPC information from the measurements it takes. In this application the staking depth and final pressure values are recorded and the results shown on SPC charts. A standard Xbar and R chart displays process trends, values of Sigma, Cp and Cpk are also calculated and displayed. A histogram is also displayed detailing distribution. The SPC data collected can be downloaded to a PC via a serial port and supplied link-software.



The 260 Series

The 260 Series is a very versatile piece of process monitoring equipment, this application details just one way it has been used. With inputs for up to 8 transducers which could be position, force, pressure, temperature or in fact a DC voltage signal from any type of transducer many process monitoring applications can be tackled. The 260 has an array of test functions that can be applied to the measured input signals, you can look for peaks, dips, averages, point values, detect shear points, monitor insertion position with feedback just for starters. This data can be displayed on the colour screen for no-nonsense setting up. The 260 also has the option to send test results to a central database via an Ethernet network link providing a record of all it has tested.

