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## Steering Assembly Test Stand

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In order to quickly analyze passenger car and truck steering systems, DTE manufactures a variety of steering gear performance test machines. These machines are capable of automatically sequencing through the following tests:

- Initialization
- Dry input torque test
- Dry return ability test
- Dry return time test
- Purge cycle
- Wet input torque test
- Wet return ability test
- Wet return time test
- Power torque test (steering effort)
- Boost curve and internal leakage test
- Backlash and pressure versus angle test
- Torsion bar test
- Purge oil from machine

DTE uses dedicated fixturing, which provides a more repeatable set-up and allows the system to test a number of steering system designs.

This system will test hydraulic power steering units consisting of a rack and pinion with an integrated power steering boost valve.

The first set of tests is run without power steering fluid flowing to the unit and the next tests are run with power steering fluid. The power steering fluid is flow/pressure controlled to emulate the power steering pump in a vehicle. Several sensors measure input and output forces and torques on the specimen, while the linear and rotary positions of the parts of the specimen are also measured. This information is collected, stored, and displayed by the software running on the PC.



The test rig also includes a hydraulic system to provide power to the two hydraulic cylinders, and a pressurized test oil system that is heated and cooled with an electronic temperature controller to maintain a constant temperature. It also has a servo valve that limits the pressure and flow to emulate a power steering pump of a vehicle.

### Tests Include:

- *Initialization:* With a fixed number of strokes, this test runs the steering rack back and forth to break in the specimen, deburring the rack and pinion, and determining the maximum travel and center point of the rack.
- *Dry input torque test:* Measure the torque required to move the rack.
- *Dry return time test:* Apply a defined force to the end of the rack and measure the time required for the rack to travel its entire stroke.

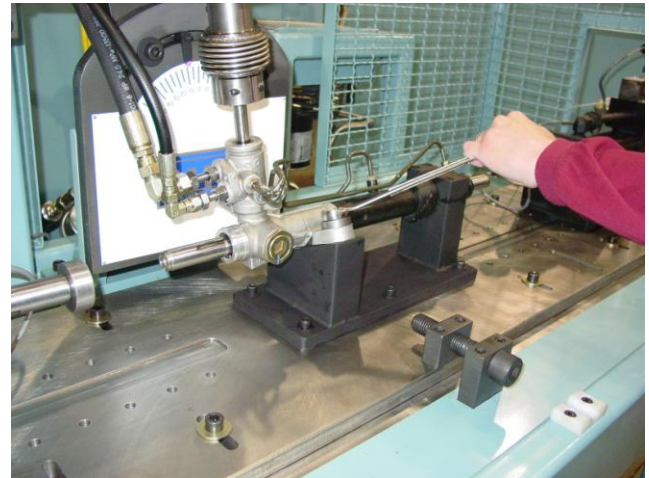
*(Tests continued)*

- *Optional Pressure drop baseline:* Determines the baseline pressure of the test oil at the defined flow rate without the specimen connected.
- *Purge Cycle:* Cycles the rack a fixed number of strokes with the test oil connected to purge air from the specimen.
- *Wet input torque test:* Measure the torque required to move the rack with test oil applied.
- *Wet return ability test:* Determine the force applied to the end of the rack that is required to move the rack at a set speed with test oil applied while the input axis is disengaged.
- *Wet return time test:* Apply a defined force to the end of the rack and measure the time required for the rack to travel its entire stroke.
- *Power Torque Test:* Measure the input torque required to overcome a defined force applied to the end of the rack.
- *Boost Curve and Internal Leakage test:* Measure the test oil inlet pressure and flow as a torque is applied with the rack locked in the center position.
- *Backlash and Stiffness and Pressure versus Angle Test:* Measure the backlash and stiffness of the rack at the center position.
- *Torsion Bar Test:* Measure the torque vs. angle characteristics (torsion coefficient) of the torsion bar.

**Test Setup:**

The operator must first enter the test specimen parameters into the software. This includes information such as; rack travel, test oil pressure, test oil flow, cw/ccw rotary axis, etc... All parameters for each test can be saved and recalled easily.

The data values recorded for each test are: parameter settings, when the test was run, and data to recreate plots / images of graphs in Excel / CSV format.



The steering axis is powered by either a hand wheel or an electric servo-motor. A magnetic coupling is used to either engage or disengage the servomotor. The rotation of the selected drive is monitored for position and torque. The angle of the steering axis is adjustable, the steering column length can be adjusted and manually locked, and two servo cylinders are used in a linear design. This reduces the error induced by friction of mechanical guiding systems. Load cells are mounted on the rod end of the actuators to monitor the load. The actuators utilize low friction seals in order to reduce stick-slip.



This system is capable of mechanically locking the gear rack in one position.

The test oil system is a self-contained hydraulic power unit with filter, drive, motor, pump, etc. The unit has the following closed loop control functions:

- Closed loop pressure control
- Closed loop control of fluid temperature.
- Maximum temperature of the test oil is 300 degrees F

The following data is acquired by the data acquisition system:

- Pressure on input to gear
- Flow on return to tank
- Fluid temperature on return to tank

A 3000PSI, 5GPM, air cooled power unit with a 10hp electric motor is used to drive the load cylinders.



**Services required:**

30 Amps 460 VAC 3 Phase