

# Turbine Mechanical Equipment – Testable Dump Manifold

## Features

- Manifold
- Solenoid valves
- Control cover
- Needle valves
- Pressure transmitter
- Logic valves
- Removable orifice
- Test points



## Testable Dump Manifold

The testable dump manifold (TDM) is designed to rapidly de-pressurize a turbine trip header. The manifold assembly is fully redundant and is testable while the turbine is on line. The operator initiates the testing sequence of the dump manifold solenoid /cartridge valve sets. The DCS automatically steps through the test and verifies successful completion of each step before proceeding. The operator is notified of a successful test and an alarm is generated indicating any failures. The DCS monitors the intermediate chamber transmitter pressure during normal operation and alarms if it varies more than a preset percentage from the expected value for more than five seconds. This condition would be indicative of a faulty cartridge valve or a blocked orifice.

Testable dump manifolds can be supplied in two formats depending on the plant tripping philosophy. The first format is a “one out of two twice” hydraulic circuit that provides two sets of redundant trip valves.

One valve in each pair must open to cause a turbine trip in this duplex design. The second format is a “two out of three” hydraulic manifold. This triplex design provides two out of three voting, within the hydraulic circuit, independent of the turbine governor control system.

The “triplex” design uses three solenoid valves and any two of the three-solenoid valves can cause a turbine trip. The triplex design TDM is used in conjunction with the stand-alone Ovation™ overspeed protection system. This system is designed for emergency governor (overspeed bolt) replacements.

### Manifold

The hydraulic manifold is machined from a solid 6061-T6 aluminum block. All crossing ports are de-burred and smoothed when possible to decrease resistance to flow. All the field connections are o-ring seal type ports, specifically SAE standard design.

Each port is uniquely identified with metal impression stampings. The stampings on the manifold correspond to the text description of the ports as shown on the TDM assembly drawing. Four tapped mounting holes are located on the bottom surface of the manifold for mounting. The manifold may be mounted in any orientation.

## Solenoid Valves

The testable dump manifold uses solenoid operated directional control valves. These valves direct hydraulic fluid to open or close the logic valves. The solenoid valves use a poppet type operating mechanism to resist silting, even during extended pressure periods. These valves offer virtually leak free closure in the checked condition. Various coil voltages are available to suit the customer requirements.

## Control Cover

The control covers are selected to direct the hydraulic fluid to the appropriate ports in the manifold assembly. Adding orifices, plugs or check valves can alter the flow path through the cover. Any change in the part number can significantly change the function of the cover. It is important to verify the part number and function of the cover when ordering a replacement part.

## Needle Valves

Needle valves are used in the TDM design for two purposes. First, to isolate the pressure transmitters from the center chamber pressure header. The location of these isolation valves is stamped on the manifold as shown on the TDM assembly drawing. Second, to measure the hydraulic fluid from the system pressure connection to the trip header, to make up for the fluid drained from the trip header to tank through the internal fixed orifices. This valve is known as the adjustable orifice or needle valve #1 (NV1) and is labeled on the manifold per the TDM assembly drawing.

## Pressure Transmitter

Pressure transmitters are used on the TDM as feedback to the DCS for both testing purposes and on-line diagnostics of the manifold condition. The

transmitter measures the pressure in a chamber between sets of cartridge valves. The pressure in this area is established by metering fluid into the chamber from the trip header and metering fluid out of the chamber to tank. The fluid is metered in, and out of the area, via fixed orifices. During normal operation, the pressure in the chamber is approximately half of the trip header pressure. When an upstream cartridge valve is opened, the chamber pressure increases to trip header pressure. When one of the downstream cartridge valves is opened, the chamber pressure decreases to tank pressure. The transmitter measures this change in pressure during the auto-test sequence. If the chamber pressure varies more than a preset percentage of the normal pressure during non-test periods, an alarm is generated. A change in the chamber pressure during normal (non-test) operation could be indicative of a faulty solenoid valve or a clogged orifice.

## Logic Valves

Cartridge logic valves are used extensively in Emerson turbine hydraulic systems. These valves offer reduced system size, fast response, low leakage, improved contamination tolerance and controllability. In the TDM design the open or closed state of a logic valve is controlled by a solenoid operated directional control valve. This solenoid valve and cartridge valve pairing is a two-stage hydraulic design. The first stage is the lower flow solenoid operated valve, and the second stage is the high flow cartridge valve.

## Removable Orifice

Simple orifices are used in turbine hydraulic systems to control flow at a given pressure. Removable orifice plugs are used in many Emerson manifold designs. Orifice plugs are used in the TDM to permit on-line testing of the solenoid valves and cartridge valves. Two orifices are used to establish a test header pressure between the trip header and the return line. The removable orifices used in Emerson hydraulic systems are made from NPT plugs with drilled holes. These removable plugs are located behind SAE straight thread plugs with the labels OR1 through OR6. Removal of the SAE plug allows access to the NPT plug below. This simple and effective design permits easy orifice change-outs and orifice size modifications in the field.

## Test Points

Test points are used throughout the Emerson hydraulic system for troubleshooting. The duplex TDM has a single test point tap on the trip header chamber. The triplex TDM uses four test points, one on the trip header and three that provide access to the chamber between the solenoid valve and the top of the cartridge valve.

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