Technical Paper

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In practice, people often misinterpret the Design Verification Test (DVT):

Understanding Shell's DVT/TAT

Nordheim (Germany) – July 01, 2019 – People don't often use the new term, DVT. They still refer to the Design Verification Test as TAT. The goal of this test is to ensure that a product meets all its design specifications. It also proves that valve design meets the requirements of a specific user. DVT/TAT increases customers' trust in the reliability of a product. It is also useful for finding problems early. DVT/TAT reduces the likelihood of having to do an expensive fix later on.

General features of a DVT/TAT test

In the petrochemical industry, DVT/TAT involves the testing of valves. Engineers test these valves to their design limits on pressure and temperature. They test ambient, elevated, and minimum temperature. The procedure includes several seat tests with the use of nitrogen. It also involves body tests (static and dynamic) with the use of helium to ensure tightness and Fugitive Emission Testing.

Engineers perform as many as about 200 mechanical cycles, which include opening and closing torques. The specification bases the acceptance criteria for required seat tests on ISO 5208. It also uses values for Shell/ body tests on ISO 15848 (FE).

DVT/TAT is part of a total valve qualification program:

• Technical documentation review
• Valve manufacturer technical audit (ISO 9001 methodology)
• Valve design validation and verification

How is DVT/TAT testing done?

1. TAMAP: Technically Accepted Manufacturers and Products

Shell has an extensive multi-annual vendor management testing procedure known as TAMAP, where vendors must undergo detailed product quality reviews. They also do a thorough screening of their quality assurance and control procedures. TAMAP assesses the capability of valve manufacturers. It ensures that they prove the full functional performance of their industrial valves.

The participation of Shell executives guarantees the standard of the reviews conducted. They challenge each phase of the supply chain. When valves have passed the TAMAP, they receive a certificate of acceptance. This certificate is valid for five years. Shell then adds the tested valve types to the TAMAP database.

Negative aspects:

• Very cost and time intensive testing procedure.
• Not common in practice.
• Shell adds the tested valve to the TAMAP database. It also adds those which were included according to valve qualification range. Any valve out of this defined range has to undergo the whole approval process again.

2. Third Party Testing (e.g. with the German TÜV Süd)

More common in practice is the testing procedure with a third party like TÜV Süd. It is not as extensive as the procedure for approval to the TAMAP database. It also does not take a long time since the manufacturer has a practical design to pass all required tests. However, it is not as safe or as professional as a TAMAP listed one. The technical procedure and conditions are identical.

The challenge of a DVT/TAT test

Designing and preparation of a product range to undergo DVT/TAT can be very challenging. It's always a defined testing procedure. (Shell tests, seat tests, FE tests static are also dynamic). It follows specified factors. These factors include setting the testing temperature at different levels. These levels should include ambient, elevated, low, and even cryogenic. It would depend on the design conditions of the valve itself. MESC SPE 77/300A also gives acceptance criteria. The primary aim of a Shell TAT is to reassure the customer. They need to know changes in temperature and pressure won't affect valve tightness. Thus, they perform the Shell, seat tightness, and fugitive emission tests, which also determine any potential leak paths to the atmosphere.

Beware of misinterpreted DVT/TAT tested valves

In the industry, many different manufacturers offer valves meeting Shell TAT requirements. However, users should also be aware if they meet the full specification.

The most common deviation is testing only from ambient temperature up to 150°. Instead, manufacturers should perform the tests on the specified full range -50° to +150°.

Another standard deviation is not performing the whole test procedure given in MESC SPE 77/300. Often customers don't know this procedure. They expect to get a TAT approved valve, but the valve has not gone through the whole procedure.

A valve consists of many different single parts made of different materials. For example, our valves consist of metal parts and graphite rings. They also contain soft seat inserts like PEEK or PTFE and other seals.

All these materials have different physical coefficients of linear expansion. This difference always harms the tightness of a valve. It happens especially at lower temperatures.

Thus, the design needs to be able to compensate for these different coefficients.

Our industrial valve experts have gained experience in many areas. For example, they already know the potential leak paths of a typical valve. This knowledge is necessary for designing a valve that can meet stringent specifications. It must also be able to fulfill a range of heavy stress tests like DVT or TAT according to MESC SPE 77/300.

Scope: 5,189 characters including spaces

Captions:

Nominal Sizes				Pressure Classes						
Flanges	Bore	Bore		150	300	600	800	900	1,500	2,500
Inch		Inch	DN							
1/2	FB	1/2	15							
3/4	RB	1/2								
3/4	FB	3/4	20							
1	RB	3/4								
1	FB	1	25			T				T
1 1/2	RB	1								
1 1/2	FB	1 1/2	40							
2	RB	1 1/2								
2	FB	2	50							

Picture 1: Shell MESC SPE 77/300 – Valves class & size qualification range.

Pictures by: Armaturenfabrik Franz Schneider GmbH + Co. KG

About AS-Schneider

The family-run company, AS-Schneider, was founded in 1875 and with over 350 employees, is one of the leading manufacturers of Instrumentation Valves and Manifolds worldwide. In the market segment for Large-Bore Diesel Engine Valves such as those used in marine propulsion and the generation of electricity, AS-Schneider is even the world market leader. With our own subsidiaries in Romania, Singapore, Dubai (UAE) and Houston (USA) and professional partners in more than 20 countries worldwide, we are located everywhere our customers need us.

Press details:

Armaturenfabrik Franz Schneider GmbH + Co. KG
Anastassija Kinstler - Marketing and Public Relations
Bahnhofplatz 12 - 74226 Nordheim - Deutschland/Germany
Tel. +49 7133 101 187, Fax +49 7133 101 160
a.kinstler@as-schneider.com, www.as-schneider.com