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		October 2023
KLM Technology Group #033, Jalan Bayu 8/1, Taman Nusa Bayu, 79200 Iskandar Puteri, Johor, Malaysia	BEST PRACTICE ON COMMISSIONING STEAM AND AIR LINE BLOWING (BEST PRACTICES)	

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SCOPE

This Best Practice specifies the major requirements on commissioning steam and air line blowing. It is applicable to all projects and covers all steam lines. It is applicable to cleaning of steam lines in any type of facility to remove foreign material.

Rust, dirt, mill scale, and construction debris present before startup in boilers, turbines, pipelines, superheaters, and other equipment are the number one cause of downtime for new systems. Steam blowing is an effective and safe method for ensuring your systems are free of contaminants before startup.

Although the start-up sequences and commissioning procedures differ to some extent from process to process, the basic philosophy and general aspects shall conform to the concepts of this Standard.

Process lines shall be flushed after hydrotesting was done and supervised by commissioning personnel. Process lines if service for air, gas and steam shall be blown with air or steam. During this operation, all instruments shall be isolated, all orifice plates, flow meter elements, control valves and safety valves shall be removed. The flushing and blowing shall be carried out through both block valves and bypasses. Hydrostatic test water shall be drained thoroughly before air or steam blowing is carried out.

High velocity steam is blown through the systems at engineered velocities and pressures and then vented to atmosphere via temporary piping just before a critical component like a steam turbine.

Steam blowing is a critical activity during the commissioning of a new steam system. Any steam system feeding a steam turbine must be steam blown to remove debris that would damage the steam turbine blades. Steam blowing is also employed to clean process steam lines and utility steam systems.

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INTRODUCTION

Commissioning shall start from the point at which steps are taken to bring the Unit/facility up to operating pressure and temperature and to cut in the feed. It shall be complete when the Unit/facility is operating at design capacity and producing products to specification.

For a project involving a number of process Units and offsite facilities, it shall be agreed between the Contractor and Company in the earliest stages of a project the sequence of the commissioning of the Units. It shall be necessary to commission utilities and some of the Units in advance of others, because of their interdependence from a process point of view.

The responsibilities of the Contractor and Company during commissioning stage should be clarified for the provision of labor, operators, specialists and service engineers, and also for the correction of faulty equipment, etc.

Prior to commissioning, each item of equipment should have its name, flowsheet number and identification number painted and/or stamped on it according to the Company's Specifications.

Manufacturer's instructions for cleaning their equipments shall be followed and implemented. The Contractor shall also follow the procedure of the Vendor after the equipment.

The objective of commissioning is to ensure that the plant is brought into production without risk to the personnel, the environment and the equipment. The Commissioning Engineer will record and track the Acceptance Test Run procedure data and make recommendations where and when adjustments need to be implemented.

Before commissioning, it is mandatory to clean the internal surface of pipes. To make it rust, dust, scales, and debris-free steam blowing is done. In case, this process is not done in a proper manner then connected critical components like a steam trap, the control valve can be damaged, or its life span will reduce drastically.

When pipe is fabricated during hot working, a heavy oxide layer forms. This layer is known as mill scale and must be removed from critical systems before putting them into service.

Over time, enhancements have been made in plant start-up techniques to perform engineered steam blows that remove mill scale. Steam blowing is a method of cleaning

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of piping system where the energy and speed of steam are used to remove the impurities from the piping network. The temperature difference during steam blowing is used to remove the mill scale due to the expansion and contraction of the pipe.

Air Line Blowing

Air blow cleaning services are a safe and cost-effective method for cleaning all types of piping systems. Typically, air blowing pre commissioning is performed after the completion of hydrotesting. Air blowing will remove loose rust, sand, dirt, and construction debris. By performing an air blowing pipe cleaning before the startup of new systems, it can be ensured that no debris or contaminants will inadvertently block valves, damage equipment, or foul the process.

Air blowing is a similar method in which high-velocity air is pumped throughout your system. In terms of when to use it, air blowing works in great combination with chemical cleaning, such as in power plant systems. The chemical cleaning solution will dissolve mill scale, and then the non-soluble particles that have been dislodged during cleaning can be removed via air blowing. This process puts less direct stress on your system than steam blowing does, so if a chemical clean will be sufficient to remove mill scale, it's easier on your system to combine it with air blowing.

There are several different configurations used for air blowing depending on the design of the piping system being cleaned. Continuous air blows are effective for small diameter pipes. Rupture air blows, also called decompression air blows, are used on large diameter piping and can be effective on very long runs of piping. A third type of air blow cleaning using a pressure vessel as a reservoir can be employed for short runs of large diameter piping.

Typical Air Blowing Procedure

Typically, an air blow project progresses as follows:

1. Systems to be cleaned are identified on the P&IDs and cleaning paths are marked. Injection points, exits points, valve positions, and equipment to be removed are detailed on the drawings.
2. Cleaning force ratios, air pressures, and cleaning velocities are calculated for each of the air blows.
3. Connection point details are recorded, and a bill of materials of temporary adaptors and equipment is created.

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4. The air blowing equipment including air compressors, air dryers, silencers, hoses, and temporary connection fittings is shipped to site.
5. In the field the Supervisor will walk down the system to be air blown following the procedure prepared by the engineer. Connection points, items to be removed, and access to the piping will be noted.
6. Verify that the piping system is isolated. The temporary air blowing equipment will then be connected to the system.
7. A safety briefing will be held and workers in the area will be notified that air blowing activities are about to start.
8. Pressurize the piping systems and release the air at the exit point. Contamination levels will be noted and the relevant parties will witness the cleaning.
9. If targets are required, they will be inserted into the exit piping via a target inserter.
10. Once the system is accepted as clean the temporary equipment will be removed from the piping and the system will be reinstated to await startup.

Steam Line Blowing

Steam blowing, one of the first phases of start-up, uses high-temperature and high-velocity steam to create a high drag force on piping surfaces. This force removes debris, grease and mill scale that forms during the milling, fabrication, and construction of piping and equipment. To remove mill scale the steam must be at a high pressure (usually 300 PSI) and temperature (usually at least 900 degrees Fahrenheit). At lower temperatures, mill scale will stay in place and can eventually break free and contaminate plant equipment during startup.

The steam blowing method is similar to the Pressurized Air blowing technique but in this case, a boiler is fired to generate the pressurized steam used for cleaning pipes. Some specialized quick opening valves with a detailed procedure in parallel with a properly designed temporary network, steam quenching devices, silencers, and debris-containing equipment are used to perform this operation.

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DEFINITIONS

Air Blows - A flushing method similar to exhaustive steam blows which uses compressed air to remove debris from pipe.

Blowing – Performed using either steam or compressed air at lower than normal operating pressures, but with mass flow rates equal too or greater than maximum mass flow rates seen under operating conditions.

Cleaning – The removal of contamination to bring a system or component to a given state of cleanness.

Cleaning Force Ratio (CFR) - The comparison of the mass velocity developed during steam line blowing with that designed for maximum continuous rating (MCR).

Component – A part, combination of parts, subassembly, or complete assembly of a system

Contractor - The persons, firm or company whose tender has been accepted by the "Employer", and includes the Contractor’s personnel representative, successors and permitted assignees.

Dry Air – Air with a consistently low dew point of 20 °F or lower.

Flush – Flowing fluid through a component or system at an adequate velocity or for a specified duration to suspend and carry away anticipated contaminants.

Fresh Water – Water that is equivalent or superior to the quality of drinking water for the particular locality or that meets the following requirements:

pH at 25 °C (77 °F)	5.5 to 8.0
Chloride	Less than 250 ppm
Fluoride	Less than 5 ppm
Sulfide	Less than 1 ppm
Total Dissolved Solids	Less than 500 ppm

Licenser or Licensor - A company duly organized and existing under the laws of the said company’s country and as referred to in the preamble to the contract.

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Mechanical Cleaning - The process of either water jet cleaning or hand cleaning; or a combination of both.

Modifications – The addition of components to, or deletion of components from, a system after system cleanliness has been verified.

Project - The equipment, machinery and materials to be procured by the "Contractor" and/or "company" and the works and/or all activities to be performed and rendered by the "Contractor" in accordance with the terms and conditions of the contract documents.

Service Blows - A steam or air blow cleaning method whereby visual examination of the steam line blowing plume is used to determine system cleanliness.

Steam Blows (Exhaustive, Cyclic, or Pulse) - A cleaning method where steam pressure is built up behind a temporary steam blow valve.

Steam Blows (Continuous) - A cleaning method where steam is generated and continuously exhausted for extended periods of time.

Steam Line Blowing - A cleaning method used to remove foreign material from facility steam line piping.

Tightness Test – Hydraulic Tightness Pressure Test is any test that is below the lowest relief valve setting of the equipment or test system. Pneumatic or combination tightness pressure test is any test that is at or below 35 % MAWP of the equipment or test system.

Unit or Units - One or all process, offsite and/or utility Units and facilities as applicable to form a complete operable refinery/ and or plant.

Welded joint - A union of two or more members produced by the application of a welding process

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