



HEXAGON
PPM

WHITE PAPER

10 EXAMPLE RULES

INTERGRAPH SMART® ENGINEERING INTEGRITY



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1. INTRODUCTION

Intergraph Smart® Engineering Integrity checks that the Smart Engineering Solutions (Intergraph Smart P&ID, Intergraph Smart Instrumentation and Intergraph Smart Electrical) comply with engineering standards and company best practices for safety and operations. It can also check across the three tasks and between the tasks and external data sources such as a spreadsheet. The system is delivered with more than 1,500 rules based on the API 14C standard and typical company engineering practices. Or the customer can quickly develop their own using the supplied simple engineering interface. You don't need a background in computer programming to customize the software. Engineering Integrity has a great value proposition for both the EPC as well as the owners to ensure a right and safe design from the start.

Generally, rules can be divided into the following categories:

- Topology verification
- Data check
- Standard verification, such as safety and operational practices
- Visual verification, for example, if labels are placed on the P&ID
- Combinations of the above



2. 10 EXAMPLE RULES

INSTRUMENTATION CHECKS

1. Check that equipment is correctly instrumented. For example, all pressure vessels must have a relief system and a pressure indicator.

FREQUENTLY REPEATED CHECKS

Some checks continually take time to manually check again and again. For example:

2. All control valves must have a fail position defined with the label on the P&ID.
3. There should be no restrictions between a pressure vessel and its relief valve. But if there is a valve, it must be labeled "car sealed open."

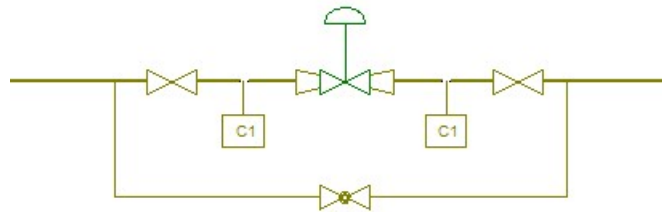
Note that the results from Intergraph Smart Engineering Integrity are versioned so that the user can check just the changes since the previous version.

CONFIGURATIONS

Intergraph Smart Engineering Integrity can check for more complex configurations. Although Smart P&ID has assemblies, there is no guarantee that the right assembly has been selected by the user or has not been modified in some way. Examples of configuration checks include:

4. Control stations should always be configured with:

- Bypass takeoff
- Block valve
- Drain
- Reducer
- Control valve
- Reducer
- Drain
- Block valve
- Bypass takeoff



And the pipe size must change either side of the control valve.

5. Block valves are required for each exchanger cooling water supply and return line when several units are in common service and the ability to take one or more out of service during operation is required to avoid shutdown. Block valves shall be:

- Gate valve for lines ≤ 200 mm
- Butterfly valve for lines > 200 mm

6. For cooling water service, provide winterization bypass for all exchangers. The bypass will be open when the exchanger is out of service and the temperature is below freezing. Provide the following bypass line sizes to maintain adequate velocities in the supply and return headers:

CW line size	Bypass size
8" or less	1"
10" to 18"	1 1/2"
20" or more	2"

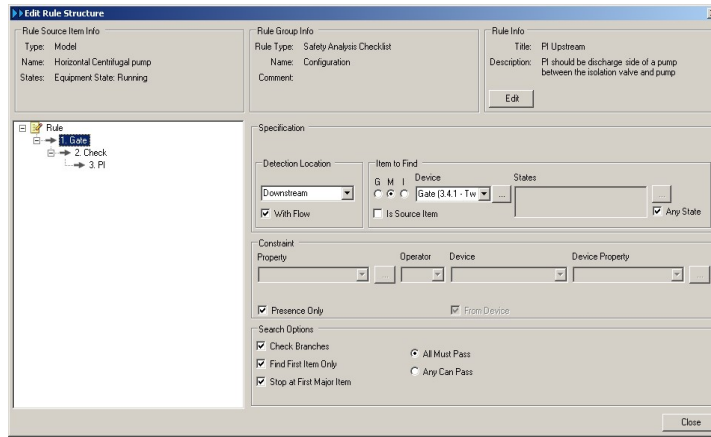
7. Drain/Vent/Steam-out Nozzle Size Check

Vessel volume, m ³	Drain	Vent	Steam-out
Less than 17.0	2"	3"	1 ½"
17.0 – 70.0	3"	4"	2"
Greater than 70.0	3"	4"	3"

ENGINEERING RULES

8. Check for high-pressure and low-pressure interfaces where the high pressure can get locked in by valves closing.
9. Check that the relief valve is set to 110 percent of the maximum allowable working pressure of the vessel and is less than the design pressure.
10. Positive isolation assemblies must be used when toxic fluids are present in the pipework and shall consist of double block and bleed arrangement with both a vent and drain connection between the double block valves. The vent and drain connection shall have double isolation valves.

USER INTERFACE EXAMPLES



The World Application Suite - Model Library Server: SPSS/SPD & Project Server

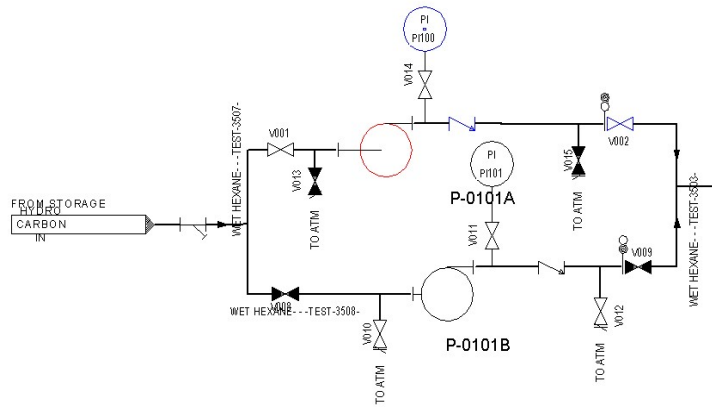
File Database Model Suite View Windows Help

User: Database: Model: View: Filter: Update: T

Rule Type: Safety analysis checklist

Rule Group	Rule	Comment
FCV-100	Configuration	Isolation Unchanged
H 101S	Configuration	Isolation Unchanged
	Configuration	Isolation (overpressure) Unchanged
	Overpressure	PSV Check Changed
	Pressure	High Pressure Changed
	Temperature	High Temperature Changed
LCV-100	Configuration	Isolation Unchanged
P-0101A	Configuration	Isolation Unchanged
	Configuration	P1 Upstream Unchanged
	Configuration	Strainers Unchanged
	Pressure	Shut In Pressure Changed
P-0102A	Configuration	Isolation Unchanged
	Configuration	P1 Upstream Unchanged
	Configuration	Strainers Unchanged
	Pressure	Shut In Pressure Unchanged
PCV-100	Configuration	Isolation Unchanged
PCV-200	Configuration	Isolation Unchanged

status icon



ENGINEER STAYS IN CONTROL

If the rule is failing, the engineer can always override the results and accept a configuration as-is. This will then be recorded in the system for later audits.



About Hexagon

Hexagon is a global leader in digital solutions that create Autonomous Connected Ecosystems (ACE). Our industry-specific solutions create smart digital realities that improve productivity and quality across manufacturing, infrastructure, safety and mobility applications.

Hexagon's PPM division empowers its clients to transform unstructured information into a smart digital asset to visualize, build and manage structures and facilities of all complexities, ensuring safe and efficient operation throughout the entire lifecycle.

Hexagon (Nasdaq Stockholm: HEXA B) has approximately 20,000 employees in 50 countries and net sales of approximately 3.5bn EUR. Learn more at hexagon.com and follow us @HexagonAB.

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