Examples of Performance Based Provisions in ASME Standards

This is a description of performance based requirements in three ASME standards. These standards vary in the degree to which the requirements are performance based.

Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 125 psi (B16.33) This standard is largely performance based and has some prescriptive requirements. Some examples of the more prescriptive requirements in B16.33 are:

- Ends must be threaded to B1.20.1 or flanged to B16.1 or B16.5
- Valves must have certain identifying markings
- All valves must be leak tested

Most of the requirements are performance based:

- Any metal can be used
- Any elastomer can be used, but must pass aging, swell and compression tests
- Any design is permitted if it meets several design qualification tests:
  - Gas tightness test
  - Temperature resistance tests
  - Hydrostatic, twist, bending, tensile strength, and turning torque structural tests
  - Flow capacity test

Code for the Operation and Maintenance of Nuclear Power Plants (OM-2004) This code is largely prescriptive and has some performance based requirements. Among the performance based requirements is the

Check Valve Condition Monitoring Program (Appendix II)
This appendix describes essential requirements for implementing and maintaining a check valve condition monitoring program, but leaves the specifics to the owner. Some of the essential requirements are:

- Determine bases for establishing groups of check valves
- Analyze the test and maintenance history that must be done
- Determine attributes to be monitored and activities needed to monitor
- Perform the needed activities
- Retain certain documentation

Safety Code for Elevators and Escalators (A17.1) This code is largely prescriptive and has some performance based requirements. Among the performance based requirements is

Rule 206.6 Design of Governor-Rope-Grip Jaws for Type B Safeties
This Code requires that electric traction elevators having a rated speed in excess of 150 feet/minute be provided with mechanical safety devices (brakes which engage the guide rails, or tracks) which are activated by an overspeed governor, which is a mechanical speed-monitoring device. A continuous governor rope (steel wire rope) is fastened to the safety-actuating mechanism on the elevator, and runs vertically throughout the hoistway, winds over the overspeed governor sheave in the machine room and runs back down the hoistway, running around another sheave in the elevator pit, then back up to the elevator. In order to activate the under-car safety, a force must be imparted to the governor rope to cause it to trip the mechanism on the car, but this force must not be infinitely high, otherwise the rope strength will be exceeded and the governor rope will break. Therefore, the governor rope must be able to slip at the point of application of the force.

Prior to the ASME A17.1c-1986 Supplement to the ASME A17.1-1984 Safety Code, the predecessor codes had very prescriptive requirements in A17.1 Rule 206.6 which required that the governors be provided with rope gripping jaws only, to the exclusion of all other means of activating the under-car safeties (brakes).

While this conventional design had served the elevator industry well in the US, it nevertheless precluded innovations. Europe, on the other hand, had no such impediment, and as a result, overspeed governors utilizing the principle of traction emerged without the necessity of rope-gripping jaws.

The prescriptive version of Rule 206.6 stated:

> Type B car and counterweight safeties shall be actuated by a speed governor equipped with rope-grip jaws which will permit the governor rope to pull through the jaws. The maximum tension in the governor rope to cause it to slip through the governor jaws shall not exceed one-fifth of the rated ultimate strength of the rope.
>
> Governor jaws shall be of such shape and minimum length that no appreciable damage to or deformation of the rope shall result from the stopping action of the jaws in operating the car or counterweight safety.

Recognizing that US technological leadership in design innovation was coming under serious challenge, we changed the rule to allow for any design which would satisfy the functional objectives of actuating the under-car safeties.

A17.1c-1986 Rule 206.6 stated the requirements in performance terms as follows:

> Type B car and counterweight safeties shall be activated by a speed governor with a governor rope-retarding means conforming to the following:
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> (a) Upon activation at the tripping speeds given by Rule 206.2, the means shall cause sufficient force to be imparted to the governor rope to activate the safety or to trip the governor rope releasing carrier, where used (Rule 205.15).
>
> (b) The means shall be set to allow the governor rope to slip through the speed governor at a rope tension higher than required to activate the safety or to trip the releasing carrier as specified in Rule 205.15. The maximum tension in the rope shall not exceed one-fifth of the rated ultimate strength of the rope.
>
> (c) The means shall be designed to prevent appreciable damage to or deformation of the governor rope resulting from its application (stopping action).
>
> (d) The means shall provide a continuous tension in the governor rope as may be required to operate the safety during the entire stopping interval in accordance with Rule 205.5b.
>
> (e) The governor shall be arranged to be tripped by hand to facilitate the tests specified in Part X.

This performance-based rule has been in effect since 1986 and has allowed the major manufacturers to benefit by the economies of scale due to commonality of designs on a worldwide basis.

Note that a performance based version of A17.1 is under development and is expected to be published soon.

Process Piping (B31.3) This code has many prescriptive and many performance based requirements. Among the performance based requirements is the permission to use unlisted materials. About unlisted materials, B31.3 says

> Unlisted materials may be used provided they conform to a published specification covering chemistry, physical and mechanical properties, method and process of manufacture, heat treatment, and quality control, and otherwise meet the requirements of this Code. Allowable stresses shall be determined in accordance with the applicable allowable stress basis of this Code or a more conservative basis.