Technical Background

UR P4 (Rev.4, Dec 2008)

Machinery Panel Task PM7302 - Revision of UR P4.5.4

1. Clause P4.3 of the UR P4 Rev.3 (February 2005), stipulates as follows:
"*The specification of piping is to be in accordance with a recognised national or international standard acceptable to Classification Society. In addition, the following requirements apply*:"

P4.3 then lists "additional requirements". These additional requirements are related to the application of pipes, rather than the manufacturing process of pipes itself. Therefore these additional requirements may not contradict that of selected national or international standards to which the pipes are manufactured.

2. Whereas P4.5.4 stipulates as follows:
"*P4.5 Material approval and Quality Control During Manufacture*
.4 Each pipe and fitting is to be tested by the manufacturer at a hydrostatic pressure not less than 1.5 times the normal pressure."

Contrary to the requirements of the P4.3, in many cases, the requirement of P4.5.4 (i.e., 100% hydrostatic pressure test at 1.5 times the rated pressure as a routine test) is not consistent with the selected national or international standard to which pipes are manufactured. The hydrostatic pressure test requirement of P4.5.4 is thought to be over and above the industry standards. However, the rationale for such an additional requirement is not apparent.

The following table shows the requirements of hydrostatic pressure test during manufacturing stipulated in five industry standards that the present study cited.

Standard	Manufacturing process	Test Requirements
ASTM D 1785 Standard specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80 and 120	Continuously-extruded pipe	1. Prototype test: Sustained pressure test at 2.1 times the pipe pressure rating for 1000 hours, and Burst pressure test: 3.2 times the pipe pressure rating. 2. No routine hydrostatic pressure test requirement during production.
ASTM F 441/F 441M Standard specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedule 40 and 80	Continuously-extruded pipe	1. Prototype test: Sustained pressure test at 2.1 times the pipe pressure rating for 1000 hours, and Burst pressure test: 3.2 times the pipe pressure rating. 2. No routine hydrostatic pressure test requirement during production.

Standard	Manufacturing process	Test Requirements
ASTM F 1412 Standard specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems	Continuously-extruded pipe	1. As prototype test, randomly selected fused joints are to be tested to 50 psi for 5 minutes. No pressure test requirements for pipe itself. 2. No routine hydrostatic pressure test requirement during production.
ASTM F 1173 Standard specification for thermosetting Resin Fiberglass Pipe Systems to Be Used for Marine Applications	Filament wound and centrifugally cast	1. Burst test, one sample per 150 joints during production. 2. 5% of pipe joints to be tested to 1.5 times the rated pressure during production.
API 15LR Specification for Low Pressure Fiberglass Line Pipe and Fittings	Filament wound and centrifugally cast	1. As prototype test, long-term cyclic hydrostatic pressure test. 2. One sample per lot (5,000 feet) to be tested to 1.5 times the rated pressure during production.

While routine pressure testing is imposed on produced FRP pipes on a sampling basis, no routine pressure test is required for PVC or CPVC pipes.

3. The level of quality assurance and quality control in production is as follows. Typically, pipes and fittings are made automatically by computerized processes, including optical measurements on line and automatic rejection of products out of tolerance. Furthermore scheduled spot checks and additional mechanical tests are made manually several times per shift to control the process itself. Typically these pipes and fittings are designed for at least a short term hydrostatic failure pressure at 4 times the MAWP, and a long term hydrostatic failure pressure at 2.5 times the MAWP.

It should be noted that the production processes based on continuous extrusion (as in PVC and CPVC pipes) and those based on centrifugal casting with wound filament (as in FRP pipe) are very different. It is thought that the difference in the testing requirements for these two manufacturing processes is simply reflecting the fact that the chance of quality failure of continuously extruded PVC or CPVC pipes is remote, and also the fact that the 100% hydrostatic test on every produced pipe, even FRP pipes, may not be warranted.

From the historically satisfactory testing results that are reported, it seems that 100% hydrostatic pressure testing at the factory on every pipe produced is not necessary.

4. Note that IMO Resolution A.753(18) "Guidelines for the application of plastic pipes on Ships" has a similar requirement to that currently in IACS UR P4. Clause 3.5 of this resolution however reads as follows:
"Each length of pipe should be tested at the manufacturer's production facility to a hydrostatic pressure not less than 1.5 times the rated pressure of the pipe. Other test criteria may be accepted by the Administration."

It seems that the last sentence "*Other test criteria may be accepted by the Administration"* is echoing the view expressed in 2 and 3 above.

5. In conclusion, IACS Members have agreed that when plastic pipes are designed and manufactured to recognized industry standards acceptable to the Society, the

requirement of 100% hydrostatic test for every produced pipe as per the UR P4.5.4 may not be necessary, accordingly the following wording has been added at the end of the clause P4.5.4:
"Alternatively, for pipes and fittings not employing hand lay up techniques, the hydrostatic pressure test may be carried out in accordance with the hydrostatic testing requirements stipulated in the recognized national or international standard to which the pipe or fittings are manufactured, provided that there is an effective quality system in place."41

Submitted by Machinery Panel Chairman
1 December 2008

Permanent Secretariat note (January 2009):
Rev.4 of UR P4 was approved by GPG on 22 December 2008 with an implementation date of 1 January 2010 (ref. 7761_IGc).