

STANDARD FOR CERTIFICATION

No. 2.9

Type Approval Programme No. 5-793.10-1

AIR VENT HEADS

OCTOBER 2008

DET NORSKE VERITAS

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FOREWORD

DET NORSKE VERITAS (DNV) is an autonomous and independent foundation with the objectives of safeguarding life, property and the environment, at sea and onshore. DNV undertakes classification, certification, and other verification and consultancy services relating to quality of ships, offshore units and installations, and onshore industries worldwide, and carries out research in relation to these functions.

Standards for Certification

Standards for Certification (previously Certification Notes) are publications that contain principles, acceptance criteria and practical information related to the Society's consideration of objects, personnel, organisations, services and operations. Standards for Certification also apply as the basis for the issue of certificates and/or declarations that may not necessarily be related to classification.

A list of Standards for Certification is found in the latest edition of Pt.0 Ch.1 of the "Rules for Classification of Ships" and the "Rules for Classification of High Speed, Light Craft and Naval Surface Craft".

The list of Standards for Certification is also included in the current "Classification Services – Publications" issued by the Society, which is available on request. All publications may be ordered from the Society's Web site <http://exchange.dnv.com>.

The Society reserves the exclusive right to interpret, decide equivalence or make exemptions to this Standard for Certification.

This issue supersedes Type Approval Programme No. 5-793.10-1 of June 2003.

Main changes

- new coating requirements
- requirement for conducting a vacuum test of the vent heads
- removing the stated request for a product certificate, to align the TAP with the DNV Classification of Ships rules.

Comments may be sent by e-mail to rules@dnv.com

Comprehensive information about DNV and the Society's services is found at the Web site <http://www.dnv.com>

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1. Scope

1.1 General

This Standard for Certification gives the requirements on which Det Norske Veritas base the approval of air vent heads.

The procedure for assessment of conformity of manufactured products (production) is not part of the scope of this Standard for Certification.

1.2 Objective

Approval of air vent heads is based upon the requirement in the relevant parts of the following DNV documents:

- Det Norske Veritas Rules for Classification of Ships
- Det Norske Veritas Rules for High Speed, Light Craft and Naval Surface Craft
- Det Norske Veritas Offshore Codes.

1.3 Application

The requirements of this Standard for Certification cover type approval of air vent heads. Det Norske Veritas does, however, reserve the right to deviate from the requirements in this document in connection with approval of air vent heads of special design or for specific applications.

2. Type Approval, general

2.1 Procedures

Type Approval Procedure consists of the following elements:

- design assessment
- type testing
- certificate retention survey

See Det Norske Veritas' Standard for Certification No. 1.2 for the general procedures regarding type approval.

2.2 Documentation to be submitted

The following documents shall be submitted in connection with application for Type Approval:

- drawings of typical design with all measures necessary for control of strength and capacity tabulated
- installation and maintenance manual
- description of function
- material specification
- manufacturer's catalogue
- diagram of differential pressure dependant on volume flow
- copy of test reports.

2.2.1 Type Approval

Type Approval is offered for identical products manufactured in series. When compliance with the requirements is acquired, a type approval certificate will be issued, and the original of the certificate will be sent to the manufacturer through his nearest DNV office. Agreements may be made for other arrangements. The Type Approval certificate is normally valid for 4 years and may be renewed upon a written request. Modification of designs and adding of new designs shall be reported, and may be included, regardless of expire date of the certificate.

2.3 Material requirements

2.3.1 General requirements

The material used shall be resistant to sea water and to possible other contents of the tank, or be properly protected. If neces-

sary, due regard shall be taken to galvanic corrosion if necessary. Closures and seat(s) made of non metallic material shall remain unaffected by sea water or other content to be carried in the tank at temperatures between -25°C and +85 °C.

2.3.2 Galvanised steel

For galvanized steel air pipes, the zinc coating shall be applied by the hot method and the thickness shall be 70 to 100 microns. This shall be stated on the drawings.

2.3.3

For areas susceptible to erosion (e.g. those parts directly subjected to ballast water impact when the tank is being pressed up, for example the inner chamber area above the air pipe, plus an overlap of 10° or more on either side) an additional harder coating e.g. aluminium bearing epoxy, or other equivalent, coating shall be applied over the zinc. *This shall be stated on the drawings.*

2.4 Design requirements

The vent heads shall be designed such that the closing mechanism operates satisfactorily at all inclinations up to $\pm 40^\circ$. It shall be possible to inspect the air vent head and the inside of the casing. Efficient seating arrangement shall be provided, and it shall be possible to change the seals easily. The air vent heads shall be self draining. In case the closing device is of the float type, suitable guides shall be provided to ensure undisturbed operation under all working conditions of heel and trim, up to an inclination of 40°.

The clearance through the air vent head shall be sufficient to give the air vent head a flow capacity of water that at least correspond to the flow capacity of corresponding pipe.

3. Elements of Type Approval

3.1 Type testing

Each type and size air vent head shall be subject to the following tests:

Valve assembly:

- Tightness test during immersing/emerging in water.
- Tests in order to define pressure drop related to volume flow. Measuring of the pressure drop versus rate of volume flow shall be carried out using water.
- Vacuum test as described in 3.6.

Non-Metallic Ball floats:

- impact test
- compression loading test.

Metallic Balls or Floats:

- impact test.

3.2 Test medium

Test medium shall be water. In special cases testing with air may be accepted. This is with the proviso, that DNV has accepted that a satisfactory method has been found for converting the obtained test figures to equivalent test figures for water.

3.3 Procedure for testing

3.3.1 Tightness test during immersion/emerging in water

An air pipe head shall be subjected to a series of tightness tests involving not less than two (2) immersion cycles under each of the following conditions:

- 1) The air pipe head shall be submerged slightly below water surface at a velocity of 4 m/min., and then be returned to the original position immediately. The quantity of leakage shall be recorded. The air pipe shall be submerged to a point slightly below the surface of the water for 5 minutes. The submerging velocity shall be approximately 8 m/min. and the air pipe vent head is to remain submerged for not less than 5 minutes. The quantity of leakage shall be recorded. The maximum allowable leakage per cycle shall not exceed 2 ml/mm of nominal diameter of inlet pipe during any individual test.
- 2) Each of the above tightness tests shall be carried out in the normal position as well as at an inclination of 40 degrees.

3.3.2 Determination of Flow Characteristics

The flow characteristics of the air vent head shall be determined. The pressure drop may be determined as a function of the volume flow, and should generally be performed for each nominal diameter of air pipe vent head. However, for vent heads of equivalent hydraulic geometry, testing of the smaller size may qualify the other sizes.

The test may be carried out with orifice plates, and for each measuring point the following data shall be recorded:

- differential pressure
- flow coefficient (C) of the orifice
- Reynolds number (Re_D)
- flow rate and pressure drop at pipe head

The flow characteristic curves shall be presented graphically in a diagram corresponding to diagram shown in Fig. 2.

The following conditions shall be satisfied:

- measuring equipment for mass and volume flow shall comply with recognised standards.
- the orifice plate shall be fitted where the flow is as laminar as possible; as a rule, it is considered that this requirement is met if the length of the straight pipe upstream and downstream of orifice plate is according to the standard.
- the test medium should be water. If another test medium is used, the specific gravity and the viscosity under the operating conditions must be known.
- the volume flow must be constant.
- the pipe shall be completely filled with the test medium.

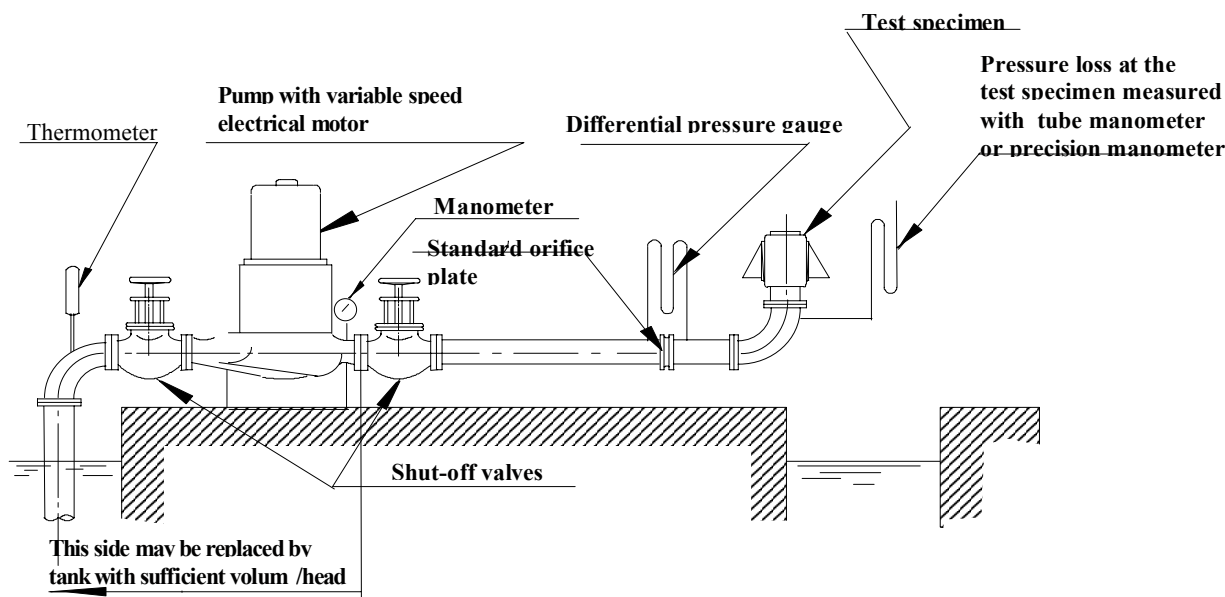
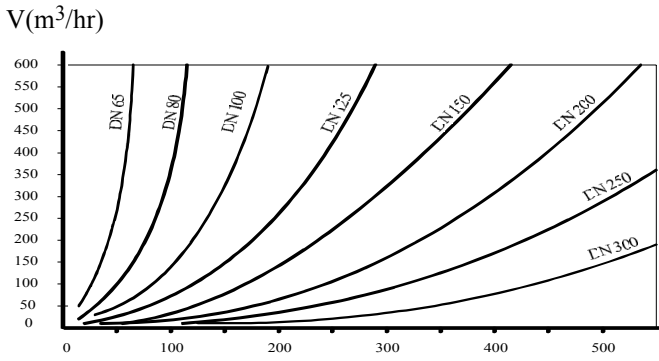


Figure 3-1
 Suggested arrangement of test plant for estimation of resistance coefficient ζ^* .

3.3.3 Test Arrangement

The test arrangement may be as shown in fig. 1, If a pump of the necessary capacity is not available, it may be replaced by a

container of sufficient volume, which will give the necessary static pressure.



Δp_n = pressure loss at test specimen
 V (m³/hr) = volume flow

Figure 3-2
Typical curves for differential pressure (pressure loss) dependant on volume flow for different sizes of air pipe heads of same design.

The volume flow may be calculated as follows:

$$V = \frac{\pi}{4} \cdot d^2 \cdot c \cdot \sqrt{2 \frac{\Delta p}{\rho_{H_2O}}} \cdot 3600 \quad (\text{m}^3 / \text{hr})$$

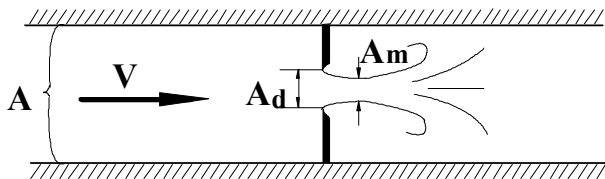


Figure 3-3

Symbols:

D =	inside diameter of piping	(m)
c =	flow coefficient of orifice plate. As an approximation c may be taken to be α .	(-)
α =	$\frac{A_m}{A_d}$	(-)
d =	inner diameter of orifice plate	(m)
A =	area of piping cross section	(m ²)
W =	$\frac{V}{A}$	(m/s)
g =	acceleration of test medium	(m/s ²)
ρ =	specific gravity	(kg/m ³)
Δp =	$h \cdot g (\rho_{H_g} - \rho_{H_2O})$ differential pressure	(N/m ²)
V =	volume flow	(m ³ /hr)
h =	differential pressure taken at standard orifice plate measured by U-tube manometer with mercury	(mmHg)
ρ_{H_2O} =	Specific gravity of water, may approximately be taken as 1000	(kg/m ³)

Exact value of α for standard orifice plates have been experimentally determined and may be taken from relevant diagrams. However a may conservatively be taken as 0.6.

The resistance characteristic curves in Fig. 2 are limited to a

volume flow of 550 m³/h and the size of the vent head to DN 300.

For big tankers the pump capacities may be much higher, and the capacities and size of test equipment may cause practical problems.

In case pump capacity and size is larger than referred to in Fig. 2, the resistance coefficient ζ^* may be calculated based on a comparison with smaller sizes of same design.

If hydraulic equivalent geometry is present, the value of the changes of resistance coefficient will probably not be of any significance.

The equivalent velocity may then be derived from the formulae:

$$\frac{V_1}{V_2} = \frac{d_1^2}{d_2^2}$$

3.3.4 Calculation of Resistance Coefficient for the Vent Head

The resistance coefficient may be calculated according to the following:

$$\zeta = \frac{2 \cdot \Delta p_v}{w^2 \cdot \rho}$$

where:

ζ = dynamic loss coefficient.
 Δp_v = pressure losses

$w = \frac{V}{A}$ = velocity of test medium (m/s)

ρ = specific gravity (kg/m³)

3.4 Testing of Balls or Floats

3.4.1 Preconditioning

Impact and pressure loading tests shall be carried out on the floats before and after preconditioning as follows:

Test condition	Test temperature		
	-25°C	20°C	85°C
Dry	yes	yes	yes
After immersing in water	yes	yes	yes
After immersing in fuel oil	no	yes	no
Immersing in water and fuel oil shall be for at least 48 hours			

3.4.2 Impact Test

The test may be conducted on a pendulum type test machine. The floats shall be subject to 5 impacts of 2.5 Nm each, and without either permanent deformation, cracking or surface deterioration at this impact loading. Subsequently the floats shall be subject to 5 impacts of 25 Nm each. At this impact level some localised surface damage may occur at the impact point. However, no permanent deformation or cracking of the floats shall appear.

3.4.3 Compression Loading Test

Compression tests shall be conducted with floats mounted on a supporting ring. The floats shall have a bearing area that corresponds to the bearing area of the valve seating width. Loads shall be applied through a concave cap of same internal diameter as the float and bearing on an area of the same diameter as the seating.

A load of 350 kg shall be applied gradually over one minute and be maintained for 60 minutes. The deflection shall be

measured at intervals of 10 minutes after the full load has been applied. The record of deflection measured, during this time, is to show no continuing increase in deflection, and after release of the load there shall be no permanent deflection.

3.4.4 Shape and Wall Thickness

The surface and the circularity of the balls shall be inspected. One ball shall be cut in 2 halves, and the biggest and the smallest thickness shall be measured. The maximum allowed tolerances for wall thickness of ball floats shall not exceed $\pm 10\%$ of the nominal thickness.

3.5 Testing of vacuum capability

3.5.1 Discharge/Reverse flow test

The air pipe shall allow the passage of air or liquid to prevent vacuum coming on to the tank. A reverse flow test shall be performed. A vacuum pump or another suitable device shall be connected to the opening of the air pipe leading to the tank. The flow velocity shall be applied gradually at a constant rate until the float gets sucked into the inlet of the air pipe and blocks the flow. The velocity at the point of blocking shall be recorded. 80% of the value recorded will be stated in the certificate.

4. Type Approval Certificate

4.1 General

When the design assessment and type testing are successfully completed, a Type Approval Certificate will be issued, to the

manufacturer, for the conformity of the design of the product type.

The Certificate is given a validity period of 4 years.

4.2 Certificate retention survey

The scope of the certificate retention survey, is to verify that the conditions stipulated for the Type Approval is complied with and that no alterations are made to the product design or choice of materials.

If regular DNV product certification of air pipe vent heads takes place during the validity period of the Type Approval Certificate, the Type Approval Certificate retention survey can be combined with the product certification survey.

The main elements of the certificate retention survey are:

- review of Type Approval documentation
- review of possible changes in design, materials and performance
- ensure traceability between manufacturer's product type marking and Type Approval Certificate.

4.3 Renewal of the Type Approval Certificate

At least three months before the period of validity expires, the certificate-holder has to apply for renewal of the certificate.

Upon receipt of the request for renewal, Det Norske Veritas will perform a renewal survey which has the same content as the retention survey stated in section 4.2.

The survey report will constitute the basis for renewal of the Type Approval and the issuance of a new certificate.