Guideline No.: F-08(201510)

F-08

HIGH-PRESSURE HOSE USED IN CO2 SYSTEM

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Foreword:

CCS Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at http://www.ccs.org.cn. Your comments or suggestions are welcomed and may be sent to our email addressed mp@ccs.org.cn.

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1 Application

1.1 This guideline is applicable to the high-pressure hoses connected to the cylinder head valve of CO2 fire extinguishing plant and the check valve on pipe header. The working pressure of high-pressure hoses is to be greater than 15MPa.

1.2 This guideline is only applicable to wire-braid-reinforced or steel wire spiraled hoses.

1.3 Manufacturer manufacturing or assembling high-pressure hoses used in CO2system are to be B type approved by CCS.

2 Normative references

2.1 The reference documents for approval and inspection used in this guideline are as follows:

2.2 Chapter 2, PART THREE of CCS Rules for Classification of Sea-going Steel Ships (2012) and Amendments thereto;

2.3 Chapter 2, PART SIX of CCS Rules for Classification of Sea-going Steel Ships (2012) and Amendments thereto;

2.4 CB/T 3294-1998 Marine CO2 Fire Extinguishing Plant;

2.5 GB/T 3683-2011 Rubber Hoses and Hose Assemblies-Wire-braid-reinforced Hydraulic Types for Oil-based or Water-based Fluids-Specification;

2.5 ISO 1436:2009 Rubber Hoses and Hose Assemblies-Wire-braid-reinforced Hydraulic Types for Oil-based or Water-based Fluids-Specification.

3 Terms and definitions

3.1 Hose:flexible pipe composed of rubber layer, wire braided layer or wire spiraled layer and usually with outer cover.

3.2 Wire-reinforced hose: hose containing steel wires to increase strength, enhance dimensional stability or flattening resistance.

3.3 Hose fitting: the fittings fitted on the end of a hose to allow connection of the hose to a facility

or to anotherhose.

3.4 Hose assembly: hose fitted with joints on one end or both ends.

3.5 Hydraulic chose: wire-braid-reinforced hose intended to be used to withstand high pressure.

3.6 Impulse: cyclic, short-duration pressure capable of generating sudden stress.

3.7 Impulse test: impulsive pressure test, which is usually applicable to high-pressure hydraulic hoses.

3.8 Insulating layer: the rubber layer between reinforcing layers.

3.9 Ply adhesion: the force required to separate two adjacent layers of the hose.

3.10 Cover: the wire braided protective layer covering the rubber hose.

3.11 Proof pressure: the pressure applied and maintained for a specified period of time during non-destructive test to prove structural integrity.

4 Type of hoses

— 1ST type: the hose with a single wire braided layer or wire spiraled layer and a thick cover;

— 2ST type: the hose with two wire braided layers or wire spiraled layers and a thick cover;

— 1SN type and R1AST type:the hose with a single wire braided layer or wire spiraled layer and a thin cover;

— 2SN and R2AST type: the hose with two wire braided layers or wire spiraled layers and a thin cover

Note: Other than the hoses having a thinner cover to allow for connection to the assembly without the need of peeling off the entire or partial cover, the dimensions of the reinforcing layers of 1SN and R1ATS type and 2SNand R2ATS type hoses are to the same as those of 1ST type and 2ST type hoses respectively.

5 Drawings and documentation

5.1 When the approval is being applied for, the following drawings and documentation are to be submitted to CCS for approval:

(1) Main product properties and specifications table (including the design pressure, design temperature, applicable medium, performance, intended purpose, etc. of all product series for which the approval is being applied, as well as the type and parameters of accessory devices);

(2) Summary table of material mechanical and chemical properties of main parts;

(3) Type test plan.

5.2 The following drawings and documentation to be submitted are to be submitted to CCS for review:

(1) Main process documents and manufacturer's self-inspectionprocedure;

(2) Product description, nameplate, manufacturer certificate of conformity (sample);

(3) Product drawings and relevant design calculations (if any).

5.3 Materials and components

(1) Main parts include rubber hose, wire braided layer or wire spiral layer, hose joint, hose assembly, etc.;

(2) Pressure parts such as high-pressure hose and hose assemblies are to be 100% hydraulically tested prior to assembly;

(3) Where the main parts described in 5.3(1) are purchased parts, a complete quality system to control the quality of subcontractor's work must be established by the applicant for the purpose of ensuring quality, and material quality certificates must be provided.

5.4 Other information to be submitted

(1) particulars of the manufacturer, including the name, address, history, production capacity, technical and inspection personnel, main products, subordinate relationship, trademark, etc.;

(2) details of the products for approval;

(3) main production equipment;

(4) main test equipment;

(5) brief production technology of the products for approval;

(6) quality management documents;

(7) document of entering to the register of enterprise;

(8) qualification certificate and/or production license;

(9) specimen of products quality certificate;

(10) quality control scheme (where applicable).

6 Technical requirements

6.1 The hose is to consist of a rubber liner resistant to oil-based or water-based hydraulic fluids, one or two high-strength wire layers and one weatherproof or oil resistant cover.

6.2 Hose assemblies fitted with hose joint on one end or both ends are to be verified through hydrostatic test, impulse test, leak test and low-temperature flexing test.

6.3 The manufacturer is to have process requirements and process documents suitable for the production or assembly of hose assemblies.

6.4 The length of hoses and hose assemblies to be delivered is to be determined through consultation between the manufacturer and the ordering party.

6.5 The fittings on both ends of hose assemblies are to match the connection interface of high pressure CO2cylinder head valve and check valve.

6.6 The dimensions of hoses are to be in line with the values given in Table 6.6:

Hose Dimensions **Table 6.6**

Nominal inner diameter *	All hose types		R1ATS, 1SN, 1ST type		1ST type		R1ATS, 1SN type	R2ATS, 2SN, 2ST type		2ST type		R2ATS, 2SN type
	Inner diameter mm		Outer diameter of reinforcing layer mm		Hose outer diameter mm		Hose outer diameter mm	Outer diameter ofreinforcing layer mm		Hose outer diameter mm		Hose outer diameter mm
	Min	max	Min	max	Min	max	Max	Min	Max	Min	Max	Max
6.3	6.1	7.0	10.6	11.7	15.1	16.7	14.1	12.1	13.3	16.7	18.3	15.7
8	7.7	8.5	12.1	13.3	16.7	18.3	15.7	13.7	14.9	18.3	19.9	17.3
10	9.3	10.1	14.5	15.7	19.0	20.6	18.1	16.1	17.3	20.6	22.2	19.7
12.5	12.3	13.5	17.5	19.1	22.2	23.8	21.5	19.0	20.6	23.8	25.4	23.1

Note:

* This nominal inner diameter corresponds to the inner diameter specified in GB/T9575.

Hoses of 6.3/8/10 inner diameters are high-pressure hoses connected to CO_2 cylinder head valve and drain pipe.

For hoses of R1ATS, 1SN type and R2ATS, 2SN type, the thickness of the cover are 0.8mm at minimum and 1.5mm at maximum.

6.7 Requirements on hydrostatic pressure

When the test is carried out according to Table 6.7 of this guideline, the maximum working pressure, proof pressure and minimum burst pressure of hoses and hose assemblies are to comply with the requirements of Table 6.7;

When the test is carried out according to Table 6.7 of this guideline, the change in the length of hoses and hose assemblies at the maximum working pressure is to be no more than +2% and no less than -4%.

Maximum Working Pressure, Proof Pressure and Minimum Burst Pressure Table 6.7

Nominal inner diameter	Maximum working pressure MPa		Proof pressure MPa		Minimum burst pressure MPa	
	1ST,1SN R1ATS type	2ST,2SN R2ATS type	1ST,1SN R1ATS type	2ST,2SN R2ATS type	1ST,1SN R1ATS type	2ST,2SN R2ATS type
6.3	22.5	40.0	45.0	80.0	90.0	160.0
8	21.5	35.0	43.0	70.0	86.0	140.0
10	18.0	33	36.0	66.0	72.0	132.0
12.5	16	27.5	32.0	55.0	64.0	110.0

7 Type test

7.1 Selection of typical test specimens

7.1.1 The typical samples selected for initial approval are to reflect the manufacturer's production levels and fabricating and testing ability. In general, the typical test specimens are to be selected from each product series for which the approval is being applied depending on the characteristics of the product, such as structure, intended purpose, design pressure, design temperature, etc. At least three representative specimens of varying dimensions are to be selected from each type of hoses.

7.1.2 For re-approval, only one most representative type or one type of maximum market demand is to be selected from each product series as the test specimenfor re-approval.

7.2 Type test of hoses

Marine high-pressure CO2 system hoses manufactured and inspected in accordance withGB/T 3683-2011 are to be type tested as per Table 7.2 and reference may be made to the said standard to determine whether such hoses are qualified or not.

Table 7.2

No.	Test item	Performance requirements	Test method
Dimensional inspection			
1.	Measurement of inner diameter	GB/T 3683-2011 6.1	GB/T 9573-2003 ISO1307
2.	Measurement of outer diameter	GB/T 3683-2011 6.1	GB/T 9573-2003 ISO1307
3.	Measurement of cover thickness	GB/T 3683-2011 6.1	GB/T 9573-2003 ISO1307
4.	Concentricity measurement	GB/T 3683-2011 6.1	GB/T 9573-2003 ISO1307
Hose tests			
5.	Proof pressure test	GB/T 3683-2011 7.2	GB/T 5563-2006 ISO1402
6.	Minimum burst pressure test	GB/T 3683-2011 7.2	GB/T 5563-2006 ISO1402
7.	Length change test	GB/T 3683-2011 7.2	GB/T 5564-2006 ISO4672
8.	Minimum bending radius test	GB/T 3683-2011 7.3	GB/T 5563-2006 ISO1402
9.	Impulse test	GB/T 3683-2011 7.4	GB/T 5568-2006 ISO6803
10.	Leak test (hose assemblies)	GB/T 3683-2011 7.5	GB/T 5563-2006 ISO1402
11.	Low-temperature flexing test	GB/T 3683-2011 7.6	GB/T 5564-2006 ISO4672
12.	Ply adhesion test	GB/T 3683-2011 7.7	GB/T 14905-2009 ISO8033
13.	Liner fluid resistance test	GB/T 3683-2011 7.9	GB/T 1690-2006
14.	Ozone resistance test	GB/T 3683-2011 7.10	GB/T 24134-2009 ISO7326
15.	Minimum flow		JB/T 8727-2004
16.	Visual inspection	GB/T 3683-2011 7.11	

7.3 The test conditions are to comply with the following requirements:

7.3.1 The manufacturer’s test lab/bench, if used as the facility for approval test, is to be examined

and confirmed satisfactory by CCS surveyor according to the requirements of 7.3.2. Otherwise, all tests are to be carried out at the premise of the verification and testing agencys approved/accepted by CCS.

7.3.2 Measuring apparatuses/instruments used for tests are to be furnished with valid metrological verification certificates and the precision of pressure gauges is to be no less than1.5%.

7.4 Determination of and exemption from test items

7.4.1 All applicable test items listed in 7.2 of this guideline are generally to be carried out for the purpose of initial approval. Exemption from the test items specified in 7.2 of this guideline may be requested in writing by the applicant provided that the conditions listed below are satisfied, and such request will be considered by CCS depending on the applicant's production conditions, production history and service records of relevant products, etc.

The applicant is able to provide the corresponding test reports recently issued (within one year) by an authoritative testing agency (e.g. State Bureau of Quality and Technical Supervision, or competent National Quality Supervision and Inspection Organization, etc.);

The applicant is able to provide the reports on corresponding test items recently endorsed (within one year) by an IACS Member Classification Society;

The products for which approval is being applied are to be manufactured via technology transfer or licensing, and design approval by CCS has been obtained for such products.

7.4.2 Re-approval is to be conducted when the approval certificate needs to be renewed. Exemption from some test items may be granted subject to negotiation between the surveyor and the applicant, provided that there has been no change to the product design drawings and production process, and that there has been no change to the technical requirements on the current type of products as specified in CCS Rules for Classification of Sea-going Steel Ships.

8 Unit/batch inspection

8.1 When product inspection is being requested by the manufacturer, documents such as the reports or data of completed inspections (except the inspection items to be witnessed as required by CCS), product quality certificates, asbestos-free declaration, etc. are to be submitted along with the request. Where witness of relevant tests is required by CCS, the product certificate will be issued after the inspectionis completed by the surveyor.

8.2 Unit/batch inspection for the products which have been B type approved by CCS

8.2.1 The inspection items are to be carried out according to the inspection plan (relevant content included in quality control plan) already approved during the approval. The test items are: A. Visual/dimensional inspection; B. Pressure test; and C. Tightness test.

8.2.2 All the above tests are to be completed independently by the manufacturer for 100% of the products. Complete test reports are to be prepared and submitted to the surveyor for review.

8.2.3 The surveyor will require re-test of the abovementioned inspection and test items, for which certain products, at least one piece, are to be randomly selected from each batch at a proportion of 5% of each batch/specification. And the surveyor will provide onsite witness when the tests are being carried out by the manufacturer.

8.2.4 At each time when unit/batch inspection is being applied for, the raw material quality certificates of the main parts of the current product batch are to be submitted along with the application to CCS surveyor for review.