

ICS 93.040;77.140.99

P28

The Record Number



Transportation Industry Standard of The People's Republic of China

JT/T791--2010

Corrugated Steel Pipe And Plate For Highway Culvert(Board)

2010-12-08 Issue

2011-03-01 Carry Out

The ministry of transport of the People's Republic of China Issue

Contents

Introduction.....	3
1.Range.....	4
2. Normative Reference File.....	4
3.Term, Destination and Symbol.....	5
4. Products Classify And Model.....	6
5 .Product Specification And Size Deviation Series.....	6
6.Technoly Requirement.....	8
7 .Test Methods.....	13
8. Inspection Rules.....	13
9.Sign Packing Transportation And Storage.....	14

Introduction

This standard according to GB/T 1.1--2009 draft rules are presented

This standard by the Chinese highway bridge and structures engineering branch, put forward and summarized

This standard drafting unit: In the first highway survey and design institute co., LTD, Xi'an Technological University, Qinghai Road expansion engineering design co., LTD, Hengshui yitong metal products co., LTD, Nanjing community construction engineering technology co., LTD, Harbin tube Las Vegas sun industry co., LTD.

This standard main draftsman: Helong Li, Bailai Liu, Shengjin Ge, Shengguang Jin, Honglin Liu, Fujun Zhan, Jinhui Shao.

Road Culverts Channels Use Corrugated Steel Pipe (Board)

1. Range

This standard has stipulated road culvert and channels use corrugated steel pipe(board) term,destination, symbol. product classify ,mould, specifications series in size deviation,Technical Requirements,Test methods Detection Rules Signs, packaging, transportation, and storage.

This standard apply to road culvert, channel use corrugated steel pipe and corrugated steel board. Other industry culvert,channel use corrugated steel pipe and corrugated steel board can refence to use.

2 Normative Reference File

The following documents for the application of this document is essential.Those references that remarked date,only the remarked version applicable to this document.those reference don't have remarked date,it is the new version application to this document(contain all modification bills).

- GB/T 228 Metal material The greenhouse tensile test method
- GB/T 470 Galvanized
- GB/T 700 carbon structural steels
- GB/T 706 hot-rolled steel section
- GB/T 709 Hot rolled steel plate and steel belt size, profile, weight and allow deviation
- GB 912 Carbon structural steels and structural low alloy steel,hot rolled thin steel sheet,hot rolled steel and steel belt
- GB/T 1231 Steel structure with high strength large hexagon head bolts,heavy series hexagon nut specifications for washers
- GB/T 1839 Galvanized layer of steel product quality test method
- GB/T 2518 Continuous hot dip galvanized steel plate and steel belt
- GB/T 3274 Carbon structural steels and structural low alloy steel,hot rolled thick steel sheet,hot rolled steel and steel belt
- GB/T 5210 color paint and varnish Pull-off test for adhesion
- GB/T 12467.1 Metal material welding quality requirements The first part:The choice of quality requirements corresponding grade
- GB/T 13912 metal coating Steel parts hot-dip galvanized layer technical requirements and test methods
- GB/T 13452.2 color paint and varnish paint determination of film thickness
- JB/T 3223 Welding material quality management procedures
- JTG D60 Highway bridge design general specification
- JT/T 722 Highway bridge girder steel structure anticorrosion coating technology conditions
- TB10212 Manufacturing specifications of railway Bridges

3. Term, Destination and Symbol.

3.1 For those term and destination apply to this document

3.1.1 helical corrugated steel pipe

Steel plate or steel belt processed helical corrugated pipe

3.1.2 annular corrugated steel pipe

Steel plate or steel belt processed annular corrugated steel pipe

3.1.3 corrugated steel pipe section

steel plate after ring processing has a certain curved surface of corrugated plate

3.1.4 length of corrugated steel pipe section

curved surface of corrugated plate arch length

3.1.5 width of corrugated steel pipe section

curved surface of corrugated plate projective width

3.1.6 wave pitch

The distance between two adjacent peaks

3.1.7 wave depth

The vertical height between peaks and troughs

3.1.8 plate thickness

The thickness of corrugated pipe wall or corrugated plate parts

3.1.9 Fillet radius

Within the circle radius peaks and troughs

3.1.10 flexibility factor

Pipe joint adapt to the transportation, lifting and installation of stiffness, With unit length of tube wall (board) inertia is apart from the express.

3.2 Symble

For those apply to this document

d --- wave high, unit of measurement (mm)

D ---corrugated steel pipe diameter(inner diameter),unit of measurement (mm)

E ---The elastic modulus of steel,unit of measurement (MPa)

FF ---Flexible coefficient of pipe joint, unit of measurement(mm/N)

H ---back fill high of pipe top,unit of measurement (mm)

I ---Culverts, channel, unit length of the tube wall of moment of inertia (plate), unit of measurement (mm^4/mm)

l ---distance of wave, unit of measurement (mm)

L_p ---length of pipe joint, unit of measurement (mm)

L_c ---length of corrugated steel pipe section, unit of measurement (mm)

L_w ---width of corrugated steel pipe section, unit of measurement (mm)

R ---knuckle radius, unit of measurement (mm)

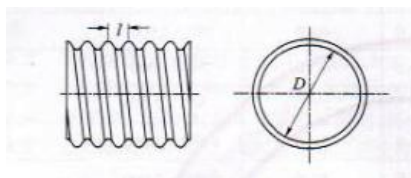
S ---distance of corrugated steel culvert and channel(when using round pipe $S=D$),unit of measurement (mm)

t ---thickness of pipe wall,unit of measurement (mm)

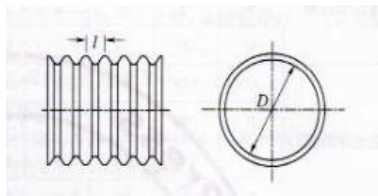
4. Products Classify And Model

4.1 Classify

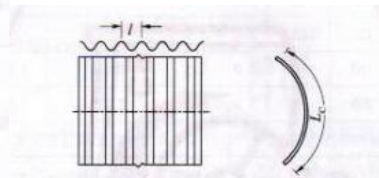
Road culvert and channel use corrugated steel pipe section can divide into helical corrugated steel pipe, annular corrugated steel pipe and assembled corrugated steel pipe. like picture 1-3



1-helical corrugated steel pipe



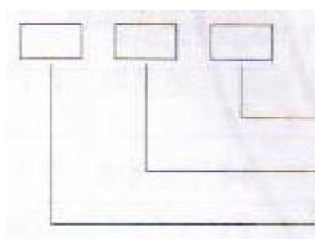
2-annular corrugated steel pipe



3-assembled corrugated steel pipe

4.2 Model

Model show as follow:



Specification, inner diameter D or arch distance S unit of measurement (mm)

Wave code, The processed waveform specifications, code is A-F (see table 1)

Product code, helical corrugated steel pipe--HCSP, annular corrugated steel pipe--ACSP, corrugated steel pipe

section--CSPC.

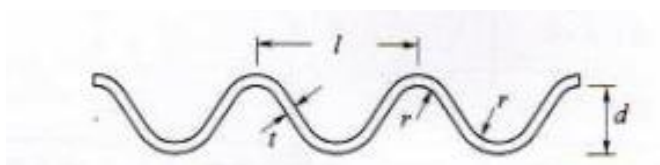
Example1: inner diameter 1000mm, helical corrugated steel pipe of wave code is A, it expresses HCSP A1000

Example2: inner diameter 2000mm, annular corrugated steel pipe of wave code is C, it expresses ACSP C2000

Example3: inner diameter 6000mm, assembled corrugated steel pipe of wave code is E, it expresses CSPC E6000

5. Product Specification And Size Deviation Series

5.1 The profile size standard of helical corrugated steel pipe, annular corrugated steel pipe and assembled corrugated steel pipe should meet the table 1. profile show is picture 4



Profile show

Table 1 Helical corrugated steel pipe, annular corrugated steel pipe and assembled corrugated steel pipe profile size standard

Classify	Wave code	Distance of wave l	Hight of wave d	Pipe wall thick t	The wave trough radius r	Apply to inner diameter D	Assembl e use high strength en bolt standard
Helical corrugated steel pipe	A	68	13	2.0-4.0	17.5	750-1500	
	B	75	25	2.0-4.5	14.3	750-2000	
	C	125	25	2.0-5.0	40.0	750-2000	
Annular corrugated steel pipe	C	125	25	2.0-5.0	40.0	750-2000	
	D	150	50	2.0-6.5	28.0	1500-2000	
	E	200	55	3.0-6.5	53.0	1500-2000	
	F	145	60	3.0-6.0	30.0	1000-2000	
Assembled corrugated steel pipe profile size standard	A	68	13	2.0-4.0	17.5	750-1500	M12
	C	125	25	2.0-5.0	40.0	750-3000	M16
	D	150	50	2.0-6.5	28.0	1500-8000	M20
	E	200	55	3.0-6.5	53.0	1500-2000	M20
Remark :Adhered on the surface of the wall thickness to the thickness of the former shall prevail, anticorrosive material thickness design should consider the mechanics characteristics and anti-corrosion requirements							

5.2 The size allowable deviation standard of helical corrugated steel pipe annular

corrugated steel pipe and assembled corrugated steel pipe should meet the table 2.

NO	Project	Allowable deviation
1	Pipe wall thick t (mm)	GB/T709 GB/T 2518
2	Wave distance l (mm)	± 3
3	Wave high d (mm)	± 3
4	Pipe joint length L_p (%)	± 2
5	Diameter D or arch distance S (%)	± 2
6	The length of corrugated steel pipe section L_c (%)	± 1
7	The width of corrugated steel pipe section L_w (%)	± 1

6. Technology Requirement

6.1 Materials

6.1.1 main section materials

6.1.1.1 when helical corrugated steel pipe annular corrugated steel pipe and assembled corrugated steel pipe use the carbon structural steels for materials, its performance should be consistent GB/T 700 requirement, the tensile strength of not less than 350MPa.

6.1.1.2 the steel plate and the steel strip of spiral corrugated steel round pipe, ring type corrugated steel round pipe must be accordance to the stipulation of GB/T 709

6.1.1.3 when using continuous hot dip galvanized steel sheet and strip processing corrugated steel pipe and corrugated steel sheet, the allowable deviations must be accordance to the stipulation of GB/T 2518, and the tensile strength is no less than 350 MPa.

6.1.2 adapting piece

6.1.2.1 the adapting piece must use torsional shear type high tensile bolt and nut, tensile strength grade should not less than 8.8 grade, the performance evaluation must be accordance to the requirement of GB/T 1231.

6.1.2.2 the specification of high tensile bolt and nut should be M12,M16,M20, the length should be 30mm-60mm.

6.1.2.3 structural high tensile gasket should be accordance to GB/T 1231.

6.1.2.4 the material of pipe clamp and flange should be carbon structural steel, performance should be accordance to GB/T 700, tensile strength should not less than 350 MPa.

6.1.2.5 the size, weight, and allowable deviation of angle iron for flange should be accordance to GB/T 706.

6.1.3 welding material

6.1.3.1 the type of welding material should be accordance to the requirement of GB/T 12467.1.

6.1.3.2 the quality management of welding material should be accordance to the requirement of JB/T3223.

6.1.4 sealing material

6.1.4.1 the joint of pipe clamp and pipe knob, joint between flange, joint between flip side, and lap joint of corrugated steel plate element should take sealing measures. The sealing material should be flexible and waterproof, and should be closely stuffed. Under low temperature conditions, the sealing material should have a good ability of antifreeze and cold-resistant.

6.1.4.2 the sealing material could use natural rubber, neoprene, polyethylene foam or weather-resistant sealant.

6.2 Processing

6.2.1 spiral corrugated round pipe

6.2.1.1 the length of spiral corrugated round pipe should be assured by the condition of hoisting, transporting and installing.

6.2.1.2 when the connection of spiral corrugated round pipe using seam type (see figure 6), the seaming should guarantee the strength of the pipe and impermeable, the minimum interval and related least spiral wave quantity should be accordance to the stipulation of sheet 3.

Sheet 3 requirement of spiral corrugated steel round pipe seaming and coupling connection.

Wave code	Minimum distance of seaming(mm)	Minimum quantity of seaming wave	Pipe clamp type	Minimum width of clamp
A	610	6	1-2 piece	410
B	533	7	2-3 piece	430
C	750	6	2-3 piece	

6.2.1.3 when spiral corrugated steel round pipe using parallel and spiral type coupling connection, the form of pipe clamp and the width should be accordance to sheet 3, the clamp steel plate thickness should not less than spiral corrugated steel pipe wall thickness. The coupling connection see figure 6.

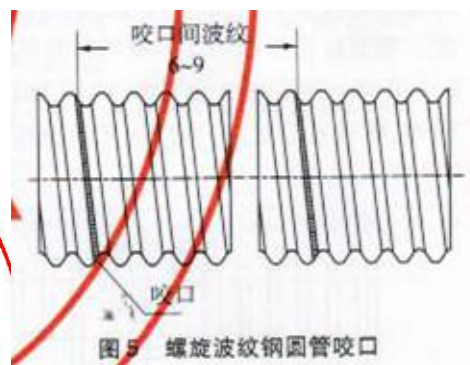




图6 螺旋波纹钢管管箍连接

6.2.2 annular corrugated steel round pipe

6.2.2.1 the length of annular corrugated steel round pipe should be assured by the condition of hoisting, transporting and installing.

6.2.2.2 when annular corrugated steel round pipe (inner diameter less than 2000mm) using axial flange type connection (figure 7), the welding and welding quality of flange and pipe junction should be accordance to TB 10212. Around the flange plate lay a single row of balance bolt hole, the location and the distance of the bolt hole should according to design. The bolt hole of two connecting flange should correspondence.

6.2.2.3 when annular corrugated steel round pipe (inner diameter 750mm-1500mm) axial direction using left-right (or up-down) half circle flip side connection (figure 8), the bolt hole should correspondence, and balance located along length-ways.

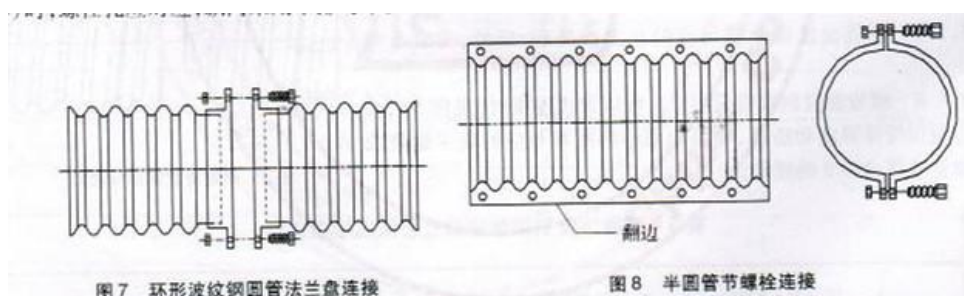


图7 环形波纹钢管管法兰连接

图8 半圆管节螺栓连接

6.2.2.4 when annular corrugated steel round pipe (inner diameter 750mm-1500mm) using pipe clamp (wave type equal to pipe) type for a axial joint, the length of the pipe clamp should not less than 5 wave distance along the axial direction, the inner diameter of the clamp should be the outer diameter of the annular corrugated steel round pipe.

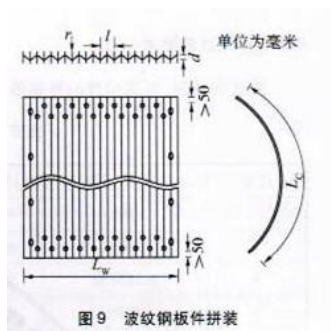
6.2.3 corrugated steel plate

6.2.3.1 the length and the width of corrugated steel plate should assured by the condition of hoisting, transporting and installing.

6.2.3.2 when assembling the corrugated steel plate, plates should be lap jointed, and connected with

high tensile strength bolts, should not be welded. When lapping the plates into circle, the distance of the lap area edge to the outer bolt hole should larger than 50mm, axial bolt hole edge distance should settled according to the wave distance.

6.2.3.3 when processing, the bolt hole location should be ascertained according to the designed arc length, wave data, and the location of the bolt holes should be kept away from area of stress concentration.



6.3 Anti-corrosion

6.3.1 carbon structural steel formed corrugated steel round pipe, corrugated steel plate, pipe clamp, flange plate, and high tensile bolt and nut, should be sent for hot dipped galvanization before leaving factory:

A) the zinc that used in hot dipped galvanization should be no.1 zinc or no.0 zinc stipulated by GB/T470, the lowest degree of steel surface manage is Sa2.5, hot dipped galvanization technical quality should be accordance to sheet 4;

B) When using hot aluminizing, electrostatic spraying methods to instead galvanization, should have test data, make sure the ability of anti-corrosion is not less than the requirement of hot dipped galvanization in sheet 4.

6.3.2 when process corrugated steel round pipe and corrugated steel plate using continuously hot dipped galvanized steel plate and steel strip, the after-process effective zinc layer thickness and quality should not lower than the requirement of sheet 4.

6.3.3 in the galvanization basis can use coating or spraying asphalt (non-metal material) to cover the surface

A) when coating, the variety, specification and performance should be accordance to the stipulation of JT/T 722. The total thickness of coating should larger than $120\ \mu\text{m}$, the surface well-distributed, smooth and continuous, no macroscopic tiny hole, space, pore, crevice, decrustation, and other defects.

B) When spraying asphalt, the thickness of asphalt should be 0.5mm-1mm, the layer should well-distributed, smooth and continuous, no macroscopic tiny hole, crevice, decrustation and other defects.

Sheet 4 quality requirement of hot dipped galvanization

Item	Requirement
Adhesion amount g/m^2	High corrosivity: corrugated steel pipe, plate and clamp ≥ 600 , bolt and nut ≥ 350 ; Mid and low corrosivity: pipe, plate and clamp ≥ 300 , bolt and nut ≥ 175

Galvanization adhesiveness	Galvanization stick tight with the metal, no stripping and no heave after hammer test
Surface quality	surface well-distributed, smooth and continuous, no sagging, no caking
Galvanization homogeneity	Well-distributed, no red sediment
Galvanization salt-resistant	After test, no corrosion on base material
Note:high corrosivity:metal surface even corrosion more than 0.5mm/year, mid corrosivity:(0.1-0.5)mm/year, low corrosivity: less than 0.1mm/year	

6.4 Performance

6.4.1 when using spiral corrugated steel pipe, annular corrugated steel pipe joint, they must stiff enough. The stiffness of the culvert joint use flexibility coefficient FF describe.

6.4.2 pipe joint flexibility coefficient FF should not larger than reference value in sheet 5
Sheet 5 reference value of flexibility coefficient of different wave

Section form	Hole dia D or S (mm)	Wave code	Wave distance	Wave height	flexibility coefficient	
					Back fill	Direct fill
Round	D<1000	A	68	13	0.245	0.245
Round	1000 ≤ D ≤ 15000	A	68	13	0.342	0.245
Round	All kind	B	75	25	0.342	0.188
Round	All kind	C	125	25	0.342	0.188
Round	All kind	D	150	50	0.114	0.114
Arch	All kind	D	150	50		0.171

6.5 Surface quality requirement

Corrugated steel culvert, passageway component surface quality should be accordance to sheet 6
Sheet 6 surface quality of corrugated steel culvert, passageway component

Serial number	Item	requirement
1	Scotch	Straightness, no obvious serration
2	Color	Surface uniform color, no obvious damage
3	Overall appearance	Surface flat and smooth, no damage, no fracture, no void, no obvious transformation of wave
4	Galvanization	Flat and smooth, well-distributed, no sagging, no caking
5	Coat layer and asphalt layer	No fracture, no peel, no void

6	Welding surface	No air hole, no flaw, no dirt and splash, galvanization of welding be accordance to this standard
7	Mechanical scratch	Not obvious
8	Transverse displacement	$\leq 5\text{mm}$

7 .Test Methods

7.1 The test of corrugated steel pipe and plate standard should use measuring instrument that have been demarcated and accuracy accordance to deviation requirement (like steel ruler).

7.2 Test method of weld inspection and weld mechanical property should accordance to stipulation of TB 10212.

7.3 The number of spiral wave of spiral corrugated steel pipe seaming use visual inspection. Distance of seaming, width of clamp, and length of lapping should use measuring instrument that have been demarcated and accuracy accordance to deviation requirement (like steel ruler).

7.4 Thickness of galvanization and adhesiveness and salt fog resistance test should be accordance to GB/T 1839, GB/T 13912.

7.5 Thickness of coating test should be accordance to GB/T 13452.2, coating film adhesiveness test should be accordance to GB/T 5210. Surface quality, uniformity test use visual inspection.

7.6 Flexibility coefficient FF of pipe joint could calculated with the formula: $FF=S^2/EI$

7.7 Corrugated steel culvert, transverse displacement of the channel test should use measuring instrument that have been demarcated and accuracy accordance to deviation requirement (like steel ruler).

7.8 Surface of galvanization, coating and other surface quality, distribution test method use visual inspection.

8. Inspection Rules

8.1 Inspection Classify

8.1.1 inspection of products can be divided into delivery inspection and type inspection.

8.1.2 products should be through delivery inspection, items accordance to 5.2, 6.2, 6.3, 6.4, 6.5. Products can't leave factory until inspection qualified and accompanied by quality inspection certificate.

8.1.3 When one of the following items happen, should progress type inspection.

A) after normal production, if structure, material, technology have a large change, that may affect product performance;

B) After normal production, every half year progress a type inspection;

C) Production halts longer than 3 months, when resuming production;

D) Delivery inspection is large different with the last type inspection.

E) national and province level quality inspection institution ask to conduct type inspection.

Type inspection items include chapter 5 and chapter 6 stipulated contents.

8.2 Group, Batch, And Sampling

8.2.1 group and batch

Products acceptance is according to batches, same batch of material, specification, production technology and stable continuous manufactured products are in a same batch. Every batch quantity should not less than 50 corrugated steel pipe joints, 100 corrugated steel plates. Less than 50 joints, 100 plates, use five days production as a batch. Sampling at scene products use a production batch as a batch.

8.2.2 sampling

Product inspection regard a batch as a unit, random pick a pipe joint, a plate from each batch for a inspection. Site sample regard the most consumable specification corrugated spiral steel pipe, annular corrugated steel pipe, corrugated steel plate as sampling objects.

8.3 Decision Rules

8.3.1 if product is qualified of 5.2, 6.2, 6.3, 6.4, while in 6.5 only one item not qualified, then it's a qualified batch.

8.3.2 if one item of 5.2 is not qualified, while qualified in 6.2, 6.3, 6.4, 6.5, then re-sampling double for inspection from the same batch, re-inspect to unqualified items. If re-inspection is qualified, then it's a qualified batch.

8.3.3 if re-inspection also contains a unqualified item or items, then it's an unqualified batch.

8.3.4 result of re-inspection is the basis of final decision.

9. Sign Packing Transportation And Storage

9.1 At least should be marked on the product: product name, model number, production date, name, size and product standard number.

9.2 When corrugated steel pipe (board) to store and transport, should be in accordance with the specifications of corrugated board, with the curvature of the line of stacked, stacked bellows should be safe.

9.3 Corrugated Steel Pipe (board) should be stored in non-corrosive, no dust, dry, well-ventilated indoor environment

9.4 Transport should pay attention to the protection of galvanizing layer, when necessary, to increase cushion

9.5 Moving the process should be handled with care, avoid hard or sharp objects mixed, avoid violent impacts, prohibition throw, toss, cast, do not damage the zinc coating

9.6 every culvert and channel should with installation instructions