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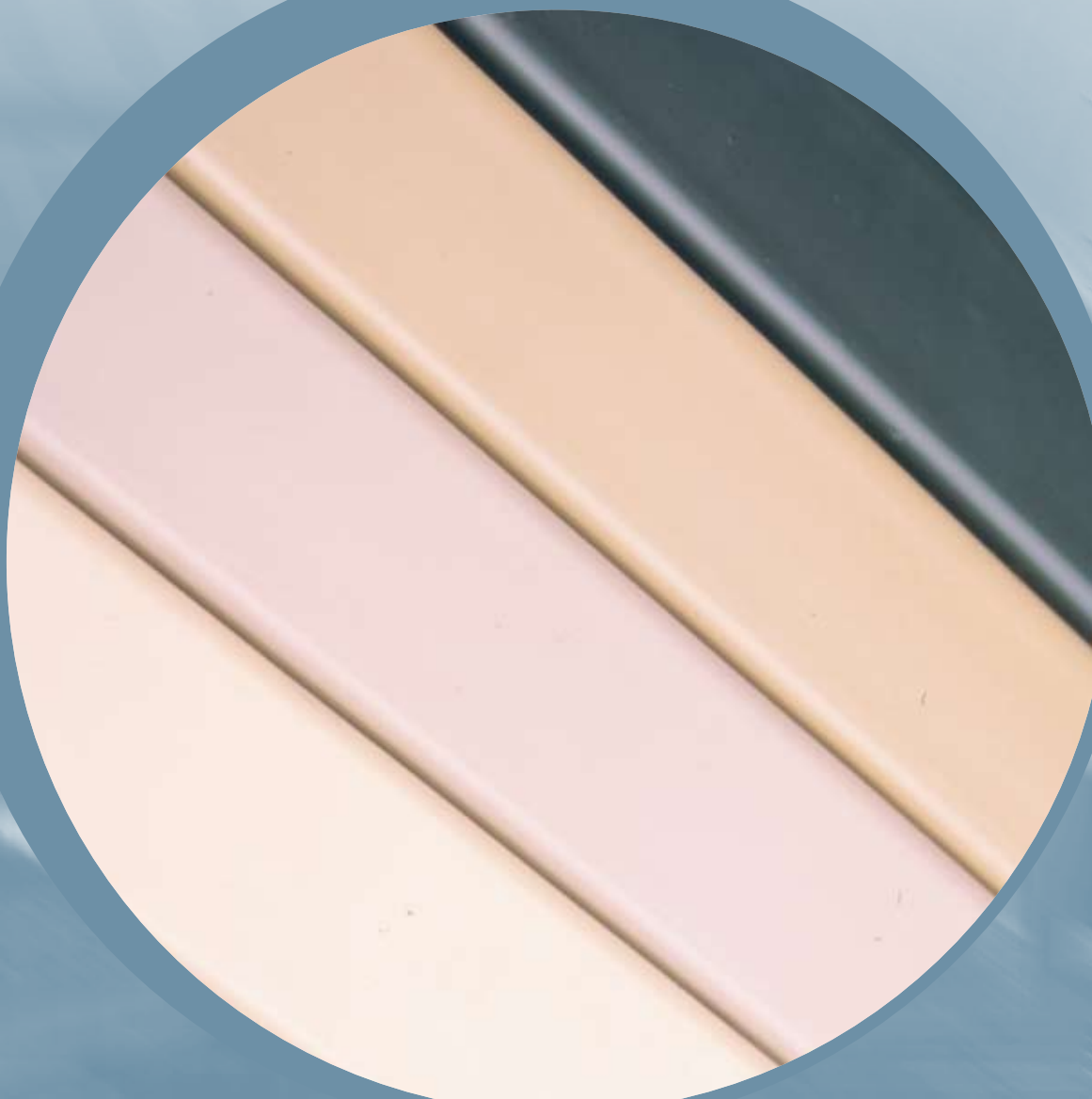
TECHNICAL SPECIFICATION - BTM® TS50

POWDER COATED ERW STEEL TUBING (TUBECOLOR®)



BTM® TS 50 | POWDER COATED ERW STEEL TUBING (TUBECOLOR®)

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1.0 Scope

This specification covers the technical requirements for the Tubecolor® process of applying a thermoset powder coat that is applied to the external surface of low carbon ERW (electric resistance welded) galvanized steel tubing.

The Tubecolor® process complies with AS/NZS 4506:2005 "Metal Finishing - Thermoset powder coatings", while the finished powder-coated product complies with the clauses of AS/NZS 4506:2005 - as stated in Section 7.0 of this specification.

This product is intended for use in general applications requiring ductile tubing and the range of products is generally designated as TS50 Tubecolor®.

Note: **1.** The Tubecolor® range can comprise powder-coated tubes using galvanized tubular products designated as "BTM® GALVATUBE™" or "DuraGal®" that are manufactured using different processes.

2. The Tubecolor® brochure will list the sizes and product material designation to differentiate the type of tubing and galvanizing substrate over which the Tubecolor® process is applied.

2.0 References

BTM® Customer Information Handbook – Standard Terminology
TS30 Low Carbon ERW BTM® GALVATUBE™ Steel Tubing for General Applications
AS 1397:2001 Steel sheet and strip – Hot dip zinc –coated or aluminum/zinc coated
AS 1163:1991 - Structural steel hollow sections
AS/NZS 4792:1999 – Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or specialized process
AS/NZS 4506:2005 Metal Finishing - Thermoset powder coatings

Notes : A copy of TS30 "Low Carbon ERW BTM® GALVATUBE™ Steel Tubing for General Applications" can be obtained from the OneSteel website at www.onesteel.com
Australian Standards can be purchased via Standards Australia bookshops or their web site at www.standards.com.au

3.0 Definitions

Terms used in this specification are defined in the BTM® Customer Information Handbook Standard Terminology, and the relevant Australian Standards referred to in Section 2 References.

4.0 Designation

Tubing ordered to this specification shall be designated as TS50 Tubecolor®

For tube ordered with special requirements or with additional/supplementary requirements the suffix S shall be used and the tube designated as TS50S Tubecolor®

5.0 Information to be Supplied by the Purchaser:

The purchaser should supply the following information at the time of an enquiry and/or order.

(a) Dimensions of cross section (diameter/non circular size and wall thickness).
(b) Length required (in mm) and type (ML, NSML, CL) - refer to clause 6.8.
(c) Designation eg TS50 Tubecolor® (plus the nominated colour eg Smooth Cream).
(d) Quantity and delivery instructions
(e) Any special requirements

6.0 Requirements

6.1 Tube Condition

Tubing shall be supplied in the Tubecolor® powder coated condition, and use tubing conforming to the following specifications or standards:

" BTM® GALVATUBE™" non-circular tubing is manufactured to BTM® specification TS30 "Low Carbon ERW BTM® GALVATUBE™ Steel Tubing for General Applications"

"DuraGal®" non-circular tubing is manufactured to Australian Standard AS 1163:1991 – "Structural steel hollow sections". DuraGal® complies with the requirements for grades C350L0 and C450L0 of AS 1163:1991, and the coating requirements of grade ILG100 in AS/NZS 4792:1999 – "Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or specialized process"

6.2 Chemical Composition

The cast analysis of the steel used shall conform to the following:

TABLE 1 : TS50 CHEMICAL COMPOSITION

		Chemical Composition % Maximum					
Product Designation	**Specification/Standard**	**C**	**Mn**	**P**	**S**	**Si**	**Al**
BTM® GALVATUBE™	BTM® specification TS30	0.10	0.45	0.02	0.030	–	–
DuraGal®	AS 1163:1991-C350L0/C450L0	0.20	1.60	0.040	0.030	0.25	0.10

6.3 Mechanical Properties

Tubing in the As-Formed condition shall conform to the following tensile properties:

TABLE 2 : TS50 MECHANICAL PROPERTIES

		Mechanical Properties		
Product Designation	**Specification/Standard**	**Yield Stress MPa (min)**	**Tensile Stress MPa (min**	**Elongation % (min)**
BTM® GALVATUBE™	BTM® specification TS30	300	350	15
DuraGal®	AS 1163:1991-C350L0/C450L0	450	500	16

6.4 Zinc Coating

6.4.1 BTM® GALVATUBE™

BTM® GALVATUBE™ non-circular tubing is manufactured using pre-galvanized (BTM® GALVATUBE™ G2 Z275) steel strip or equivalent, that complies with Australian specification AS 1397:2001 "Steel sheet and strip – Hot dip zinc –coated or aluminum/zinc coated" and is coated on both surfaces.

In the ERW process the BTM® GALVATUBE™ zinc coating is burnt off in the weld area. The external weld area is re-coated using zinc spray to re-instate the same level of protection as the original coating. The spray coating applied to the external weld area is controlled to provide a smooth surface finish that blends with the original zinc coating.

6.4.2 DuraGal®

DuraGal® non-circular tubing is manufactured with an external zinc coating applied over a prepared metal surface (including the external weld area) to produce a fully bonded coating with a minimum average coating mass of 100g/m^2, in accordance with AS/NZS 4792:1999 – "Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or specialized process". The external coating mass complies with the requirements of coating type ILG100 of AS/NZS 4792.
The internal surface is painted.

Note: The different external zinc coating processes used for GALVATUBE™ and DuraGal® result in different zinc coating surface characteristics.

Notwithstanding the above, the overall appearance of the final Tubecolor® finish shall be consistent with good workmanship, and the finished powder coated surface shall comply with the requirement for "Appearance" in Section 7.2 of this specification

6.5 Dimensions (Prior to Powder Coating)

6.5.1 BTM® GALVATUBE™

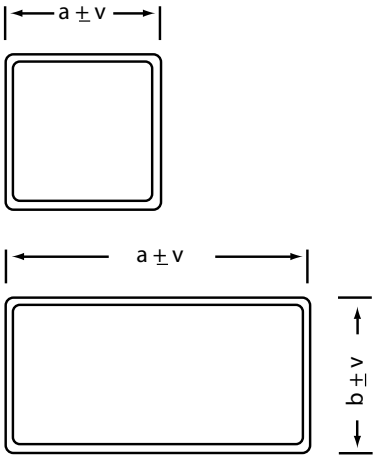
BTM® GALVATUBE™ non-circular tubing shall conform to the dimensional requirements of TS30 Low Carbon ERW BTM® GALVATUBE™ Steel Tubing for General Applications.

6.5.2 DuraGal®

DuraGal® non-circular tubing shall conform to the dimensional requirements of AS 1163:1991 – Structural steel hollow sections.

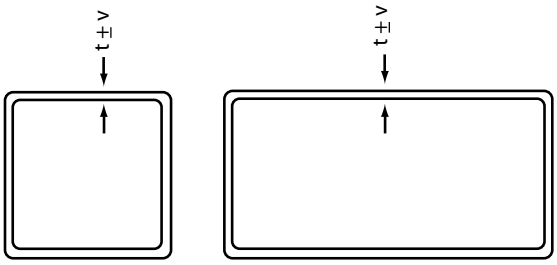
TABLE 3 : OUTSIDE DIMENSION TOLERANCES - NON CIRCULAR

Dimension, *a* (mm)	Maximum Permissible Variation in Dimension[1] *v* (mm)	Maximum Permissible Out of Square at Corners (degrees)
BTM® GALVATUBE™		
$a \leq 20$	± 0.15	0.60
$20 < a \leq 40$	± 0.20	
$40 < a \leq 60$	± 0.25	
$60 < a \leq 80$	± 0.25	
$80 < a \leq 100$	± 0.35	
DuraGal®		
$a \leq 50$	± 0.50	1.0
$a < 50$	± 0.01a or ± 0.01b	



Note: 1. In the case of rectangles the tolerance shown for the long side shall also be applied to the short side (eg. the tolerances for 5025 rectangular tube shall be 50.0 ± 0.25mm x 25.0 ± 0.25mm).

TABLE 4 : WALL THICKNESS TOLERANCE	
Wall Thickness, *t* (mm)	**Maximum Permissible Variation in Wall Thickness, *v* (mm)**
BTM® GALVATUBE™	
$t \leq 1.0$	± 0.10
$1.0 < t \leq 1.6$	± 0.15
$1.6 < t \leq 2.0$	± 0.20
$2.0 < t \leq 3.0$	± 0.25
$3.0 < t \leq 4.0$	± 0.30
$4.0 < t \leq 5.0$	± 0.35
$5.0 < t \leq 6.0$	± 0.40
DuraGal®	
All	± 10%



Notes: BTM® GALVATUBE™ and DuraGal®

1 Due to the possible distortion of the tube on cutting, the tolerances shown do not apply for a distance of 25 mm from the ends of mill cut tubes.

2. During the tube making process, internal stresses can build up as a result of the effect of cold working, the tube may change shape near the end upon cutting to final length as these internal stresses are released.

3. Tighter tolerances may be available, subject to enquiry and prior agreement between the manufacturer and the purchaser, and would be supplied to TS50S.

4. Tolerances for tubes with dimensions and wall thickness other than those listed in tables 3, 4 & 5 will be the subject of an enquiry and prior agreement between the manufacturer and the purchaser.

6.6 Height of the Weld Upset

The external weld upset shall be removed. The internal weld upset or fin is not normally removed.

Notes:

1. **BTM® GALVATUBE™** the internal fin height may measure up to 1.0 mm or 50% of the nominal wall thickness whichever is the greater. Subject to enquiry, tube with other than Normal Fin (NF) conditions may be supplied
2. **DuraGal®** there are no quantitative limits specified on the internal fin height, and internal fin removal is not a mill option for DuraGal® sections

6.7 Weldline Location

No action is normally taken to control the exact location of the weldline. Where weldline location is a critical feature this should be the subject of an enquiry and prior agreement between the manufacturer and the purchaser, and would be supplied as TS50S

6.8 Length

6.8.1 Mill Lengths

Unless otherwise specified on the order, Tubecolor® shall be supplied in standard mill lengths (ML) or as Non-Standard mill lengths (NSML) as below:

(A) BTM® GALVATUBE™ in Mill Lengths (ML) of 6100 mm (6.1 metres) or, subject to enquiry supplied as a non-standard mill length (NSML) within the length range 4000 to 8000 mm eg. 5050 mm NSML. In both cases, a length tolerance of plus 50mm minus nil shall apply.

Note: Due to manual handling restrictions, NSMLs are normally only supplied within the length range 4000 to 8000mm, however, by arrangement with the mill, lengths outside of this range may be supplied in some cases.

(B) DuraGal® in Mill Lengths (ML) of 8000 mm (8.0 metres) or subject to enquiry, supplied as a non-standard mill length (NSML) within the length range 5000 to 8000 mm eg. 5050 mm NSML. In both cases, a length tolerance of plus 50mm minus nil shall apply.

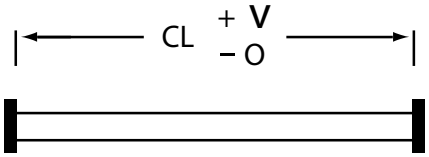
6.8.2 Cut Lengths

(A) BTM® GALVATUBE™ by arrangement, tubing can be supplied as cut lengths (CL). The tolerances applicable to cut lengths are:

TABLE 7 : CUT LENGTH TOLERANCES

Cut Length, CL (mm)	Max. Permissible Variation in Cut Length, v (mm)
CL ≤ 1000	+ 1.0, - Nil
1000 < CL ≤ 2000	+ 1.5, - Nil
2000 < CL ≤ 4000	+ 3.0, - Nil
4000 < CL ≤ 6000	+ 4.5, - Nil
CL > 6000	+ 6.0, - Nil

Note: **1.** The tube length shall be taken to be the measured distance between two parallel plates in contact with each end of the tube. This could vary from the overall length measured along the outside of the tube using a micrometer, vernier or similar device due to the tolerance for end squareness.

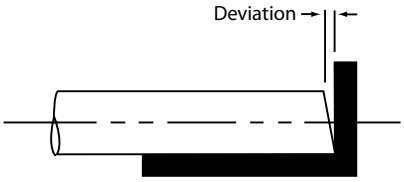


(B) DuraGal® cut lengths are not available.

6.8.3 End Squareness (applicable only to cut lengths up to 1000 mm)

End squareness shall be expressed as the maximum deviation that can be measured between the end of the tube and a straight edge in contact with the end of the tube and at right angles to the tube axis. The maximum allowable out of squareness shall be:

(A) BTM® GALVATUBE™ 0.05 mm per 10 mm of O.D. (equivalent to 0.3°).



(B) DuraGal® cut lengths are not available.

6.9 End Condition

6.9.1 Mill Lengths (BTM® GALVATUBE™ and DuraGal®)

Tubecolor® when normally supplied in standard mill lengths (ML) or non-standard mill lengths (NSML) shall be supplied with shear or saw cut mill ends that may have a small shear dimple or burrs.

6.9.2 Cut Lengths (BTM® GALVATUBE™ only)

Cut lengths can be supplied with the following specific end conditions:

(a) As Cut

Tube ends will be as cut by saw, not shear, lathe or laser and some cutting burr could remain.

(b) Deburred

Safe to handle and no dimensional evidence of burr on the outside or inside of the tube. The aim is to completely remove the external and internal burr with minimum stock removal. Unless otherwise specified, there may be evidence of a burr on the end face. Tool chatter is to be avoided but shall not be cause for rejection (workmanship).

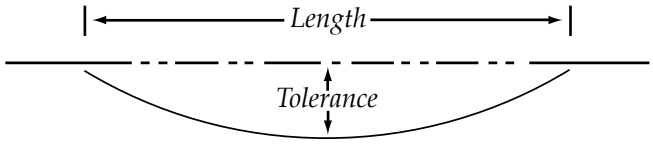
6.10 Straightness

For lengths greater than or equal to 1000 mm the straightness tolerance shall be as shown in the table below, which assumes the tube to be bent in a constant radius, measured against a straight edge.

For lengths less than 1000 mm the straightness tolerance shall be 1.0mm maximum deviation.

TABLE 10 : STRAIGHTNESS TOLERANCE

Length (mm)	1,000	2,000	3,000	4,000	5,000	6,000	6,100	7,000	8,000
Tolerance (mm)	1.0	1.1	2.5	4.4	6.9	10.0	10.3	13.6	17.8



By arrangement, tube with other straightness tolerances can be supplied in some cases.

7.0 Tubecolor® Powder Coating

The Tubecolor® powder coating shall after curing, conform to the following product performance requirements as set out in Section 2.0 of AS/NZS 4506:2005 Metal Finishing – Thermoset powder coatings.

7.1 Pretreatment

A Zinc Phosphate pretreatment is applied prior to powder coating to comply with the requirement of Section 2.0, clause 2.2 and Table 2.1 of AS/NZS 4506:2005

7.2 Appearance

Complies with the requirements of Section 2.0, clause 2.3 of AS/NZS 4506:2005, which requires that architectural and other large components when normally viewed from a distance of 3m shall have uniform appearance, colour and texture and be essentially free of visible defects such as blisters or other surface imperfections.

Notes:

1. Defects referred to in this section of AS/NZS 4506 cannot be completely quantified. Where the presence, size or frequency of any coating defects is considered to be of concern, arrangements should be made between the purchaser and manufacturer.

2. The viewing distance is subject to agreement between the purchaser, the manufacturer and the end user.

7.3 Specular Gloss

Complies with the requirement of Section 2.0, clause 2.4 of AS/NZS 4506:2005 which requires determination in accordance with AS/NZS 1580.602.2 using a 60 degree exposure head, the measurable specular gloss shall not vary by more than +/- 7 gloss units from the specified value.

7.4 Coating Thickness

The film thickness of the Tubecolor® powder coating shall be a minimum of 60 microns, to comply with the service condition category 4 (Tropical – exterior) and category 5 (Severe - exterior) of Section 2.0, Clause 2.5 and Table 2.1 of AS/NZS 4506:2005. Measurement of the coating thickness will be in accordance with AS/NZS 1580.108.2

7.5 Cure Test

Complies with the requirement of Section 2.0, clause 2.6 of AS/NZS 4506:2005

The effectiveness of the curing shall be tested by placing one drop of a special solvent (propylene glycol methyl ether acetate or similar) on the powder coated surface, waiting 30 seconds and then testing with a fingernail for softening.

Slight softening of the surface is permissible (surface rehardens when solvent fully evaporates) but severe softening or dissolution of the coating indicates under-curing and shall be cause for rejection.

7.6 Adhesion (Cross-Cut)

Complies with the requirement of Section 2.0, clause 2.7 of AS/NZS 4506:2005

The test shall be carried out in accordance with the procedures laid down in Australian Standard AS 1580.408.4 Adhesion (Cross-Cut). After testing, the appearance of the surface of the cross-cut area shall not be worse than classification 1 in AS 1580.408.4.

7.7 Water Permeability (Boiling Water) Test

A sample subjected to two hours immersion in demineralised water in a pressure cooker as described in British standard BS 1746, shall show no blistering and shall pass classification 1 of the adhesion test referred to in clause 7.6 above.

Note: Compliance with any additional performance requirements of AS/NZS 4506 not listed in section 7.0 will be subject to enquiry and prior agreement between the manufacturer and the purchaser.

8.0 Maintenance

It is recommended that Tubecolor® be maintained in accordance with the informative guidelines contained in Appendix C of AS/NZS 4506:2005 Appendix D which includes regular washing down of the product.

9.0 Packaging

Standard packaging for BTM® GALVATUBE™ sections within this specification is strapped rectangular packs, with battens on the underside of the pack.

DuraGal® involves larger and heavier sections in longer lengths; purchasers should check the packaging details with the steel supplier at the time of enquiry or order placement.

10.0 Special Requirements

Any other requirements not covered by the above clauses should be the subject of any enquiry prior to placement of an order.

11.0 Control

This specification is not to be reproduced without the authority of the originator.
Holders of this specification should determine its validity prior to use.

BTM® TUBE PRODUCTS

Technical specifications are also available for the following BTM® Precision Tubing products:

TS 11	Black (hot rolled) ERW steel tubing for general applications
TS 21	Low carbon ERW steel tubing for general applications (EzyForm™)
TS 22	ERW steel tubing with specified mechanical properties (Hi-Lite®)
TS 28	Low carbon ERW Hi-Form® and Hi-Form® (Aluminised) steel tubing for use in automotive exhaust systems
TS 30	Low carbon ERW GALVATUBE™ steel tubing for general applications
TS 31	Low carbon ERW steel tubing with special requirements
TS 41	Low carbon ERW steel tubing for fluid carrying applications.
TS 50	Powder coated ERW steel tubing (Tubecolor®).

OneSteel has a range of other Technical Specifications for products and/or applications not listed above. Please contact OneSteel Direct for further Information or visit our website www.onesteel.com

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