

## Foreword

The pursuance of this national standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled “Development of Standards for Slaughterhouse Equipment for Large Ruminants” which was funded by the Department of Agriculture – National Meat Inspection Services (DA-NMIS).

This standard has been technically prepared in accordance with BPS Directives Part 3:2003 – Rules for the Structure and Drafting of International Standards.

The word “shall” is used to indicate mandatory requirements to conform to the standard.

The word “should” is used to indicate that among several possibilities one is recommended as particularly suitable without mentioning or excluding others.

In preparation of this standard, the following documents/publications were considered:

PAES 512:2007 Slaughterhouse Equipment – Overhead Rail System for Hogs –  
Methods of Test

Baumeister, T., E.A. Avallone and T. Baumeister III. 1978. *Mark's Standard Handbook for Mechanical Engineers*. 8<sup>th</sup> ed. McGraw – Hill, Inc.

Tordillo, Jose Arvin S. *Mechanical Engineering Formulas*. 2002. DMC Busa Printers.

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**Slaughterhouse Equipment – Overhead Rail System for Large Ruminants –  
Methods of Test**

---

**1 Scope**

This standard specifies the methods of test and inspection for overhead rail system for large ruminants. Specifically, it shall be used to:

- 1.1 verify the mechanism, dimensions, materials, installation, accessories of the overhead rail system and the list of specifications submitted by the fabricator;
- 1.2 determine the performance of the equipment;
- 1.3 report the results of the tests

**2 References**

The following normative documents contain provisions, which through reference in this text constitute provisions of these standards:

- |                      |  |
|----------------------|--|
| <b>PAES 411:2000</b> | Agricultural Structures – Slaughterhouse for Swine, Small and Large Animals – General Requirements |
| <b>PAES 517:2008</b> | Slaughterhouse Equipment – Overhead Rail System for Large Ruminants – Specifications               |

**3 Definitions**

For the purpose of this standard, the definitions given in PAES 517 and the following shall apply:

**3.1****bending****flexural stress**

stress caused by bending moment at a given point in the beam supporting the overhead rail system

**3.2****fracture**

deformation caused by excessive stress applied to the overhead rail system

**3.3****hanger/bracket spacing**

horizontal distance between rail hangers

### **3.4**

#### **live weight**

weight of animal prior to slaughtering

### **3.5**

#### **moving load capacity**

maximum load capacity of overhead rail system in one (1) meter distance, expressed in kilogram

### **3.6**

#### **overall length**

distance of the entire track

### **3.7**

#### **sagging**

failure due to elastic instability of the overhead rail system

### **3.8**

#### **speed reduction**

ratio of the speed of conveyor without load to the speed of conveyor with load, expressed in percent

### **3.9**

#### **rail slope**

ratio of the change in rail height to the change in horizontal distance, expressed in percent

### **3.10**

#### **rail spacing**

center to center distance between parallel rail tracks

### **3.11**

#### **tensile stress**

average normal stress at any point on the cross sectional area of the overhead rail system

## **4 General Conditions for Test and Inspection**

### **4.1 Role of fabricator/dealer**

The fabricator shall submit specifications and other relevant information about the overhead railing and shall abide with the terms and conditions set forth by the official testing agency.

### **4.2 Role of the operator**

An officially designated operator shall be skilled and shall be able to demonstrate, operate, adjust and repair as the case may be related to the operation of the equipment.

### **4.3 Test site conditions**

The overhead railing shall be tested as installed in the slaughterhouse. The site should have ample provision for material handling and suitable for normal working condition conforming to PAES 411.

### **4.4 Test instruments**

The instruments to be used shall have been calibrated and checked by testing agency prior to the conduct of testing. The suggested list of minimum test instruments and materials needed to carry out the overhead rail system test is shown in Annex A.

### **4.5 Test material**

Test materials to be used shall be test weights with the following characteristics:

#### **4.5.1 Test material characteristics**

Test weights or fabricated weight materials such as solid metals; wood; bagged sand, stone/gravel, etc.; or its combination, may be used during the performance test of the overhead rail system.

#### **4.5.2 Quantity to be supplied**

Test weights or fabricated weight materials of at least 500 kg each shall be used for manual, semi-mechanized and mechanized type of rail system. The number of test weights shall be dependent on the total length of the rail system in between three (3) supports. The maximum moving load of two (2) tons per meter as indicated in PAES 517 shall be used as the basis in determining the number of test weights to be used.

### **4.6 Termination of Test**

If during the test run, the rail system fails due to major component breakdown or malfunctions the test shall be terminated by the test engineer.

## **5 Test and Inspection**

### **5.1 Verification of the manufacturer's technical data and information**

**5.1.1** This inspection is carried out to verify the mechanisms, dimensions, materials, fabrication and accessories of the overhead rail system in comparison with the list of manufacturer's technical data and information.

**5.1.2** The items to be inspected and verified shall be recorded in Annex B.

### **5.2 Performance test**

**5.2.1** This is carried out to obtain actual data on overall system performance.

- 5.2.2 Initial data of the test weights shall be recorded.
- 5.2.3 Evaluation on the capacity of the rail system statically and dynamically shall be verified.

**5.2.3.1 Manually operated and semi-mechanized**

- 5.2.3.1.1 Test weights shall be suspended at shackling point.
- 5.2.3.1.2 Once test weight is suspended, a slight push shall be made to check for the alignment, slope and fabrication finish.
- 5.2.3.1.3 Observations for any sign of failure in any part of the overhead rail system, such as buckling and fracture shall be recorded in Annex C.
- 5.2.3.1.4 Visual inspection acceptance test shall be made on welded parts of the rail system and shall be recorded in Annex C.2.1.2.

**5.2.3.2 Mechanized**

- 5.2.3.2.1 Test weight is suspended at the shackling point.
- 5.2.3.2.2 Once the test weight is suspended, it is conveyed mechanically along the rail track to check for the alignment, slope and fabrication finish.
- 5.2.3.2.3 Speed of the conveyor shall be noted and shall be compared with the specified speed by the manufacturer.
- 5.2.3.2.4 Speed reduction shall be computed.
- 5.2.3.2.5 Observation for sign of failure in any part of the overhead rail system, such as buckling and fracture shall be recorded in Annex C.
- 5.2.3.2.6 Visual inspection acceptance test shall be made on welded parts of the rail system and shall be recorded in Annex C.2.2.6.
- 5.2.3.2.7 For other observation(s) not stated, an additional sheet may be provided.

**5.2.4 Data collection**

**5.2.4.1 Power Consumption**

In case of mechanized system where electric motor is used as the prime mover, a power meter shall be used to measure the electric energy consumption.

**5.2.4.2 Data recording and observations**

Record sheet for all data and information during the test is given in Annex C.

## **6 Formula**

The formulas to be used during calculations and testing are given in Annex D.

## **7 Test Report**

The test report shall include the following information in the order given:

**7.1** Title

**7.2** Summary

**7.3** Purpose and Scope of Test

**7.4** Methods of Test

**7.5** Description of the Equipment

Table 1 – Equipment Specifications

**7.6** Results and Discussions

**7.7** Observations (include pictures)

Table 2 – Performance test data

**7.8** Name(s), signature(s) and designation of test engineer(s)

**Annex A**  
(informative)

**Suggested Minimum List of  
Test Instruments and Materials**

| <b>A.1</b>    | <b>Instruments</b>   | <b>Quantity</b> |
|---------------|--|-----------------|
| <b>A.1.1</b>  | Tachometer (contact type or photo electric type)<br>Range: 0 rpm to 5,000 rpm                                      | 1               |
| <b>A.1.2</b>  | Digital timers (range: 60 minutes)<br>Accuracy: 0.1 sec  | 1               |
| <b>A.1.3</b>  | Vernier Caliper, 200mm length, 0.05 mm accuracy  | 1               |
| <b>A.1.4</b>  | Weighing scale (capacity: 1000 kg)<br>0.1 kg accuracy  | 1               |
| <b>A.1.5</b>  | Power meter (for electric motors)<br>60 Hz, 220 V  | 1               |
| <b>A.1.6</b>  | Camera   | 1               |
| <b>A.1.7</b>  | Dumping level  | 1               |
| <b>A.1.8</b>  | Tape measure   | 1               |
| <b>A.1.9</b>  | Handheld vibration meter<br>Frequency range: (10 Hz to 1 kHz)  | 1               |
| <b>A.2</b>    | <b>Materials</b>   |                 |
| <b>A.2.1</b>  | Labelling tags which include   |                 |
| <b>A.2.2.</b> | Date of test   |                 |
| <b>A.2.3</b>  | Overhead railing test  |                 |
| <b>A.2.4</b>  | Test weights<br>500 kg each (Manual and semi-mechanized type of rail<br>system and Mechanized type of rail system) |                 |
| <b>A.2.5</b>  | Trial number   |                 |
| <b>A.2.6</b>  | Permanent marking pen  | 1               |



**Annex B**  
(informative)

**Specifications of Overhead Rail System**

Name of Applicant/Distributor: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Tel No: \_\_\_\_\_  
 Name of Manufacturer: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Tel No: \_\_\_\_\_

**General Information**

Classification: \_\_\_\_\_  
 Serial No: \_\_\_\_\_ Type: \_\_\_\_\_  
 Installation date of overhead railings to be tested: \_\_\_\_\_  
 Testing Agency: \_\_\_\_\_ Test Engineer: \_\_\_\_\_  
 Date of Test: \_\_\_\_\_ Location of Test: \_\_\_\_\_

**Items to be inspected**

| ITEMS  | Manufacturer's Specification | Verification by the Testing Agency |
|--|------------------------------|------------------------------------|
| <b>B.1 Main structures</b>                           |                              |                                    |
| <b>B.1.1</b> Material                                |                              |                                    |
| <b>B.1.2</b> Overall length, m                       |                              |                                    |
| <b>B.2 Main frame railing</b>                        |                              |                                    |
| <b>B.2.1</b> Material                                |                              |                                    |
| <b>B.2.2</b> Rail spacing, mm                        |                              |                                    |
| <b>B.2.3 Dimensions, mm</b>                          |                              |                                    |
| <b>B.2.3.1</b> Width                                 |                              |                                    |
| <b>B.2.3.2</b> Thickness, mm                         |                              |                                    |
| <b>B.2.4</b> Maximum load capacity (static),<br>kg/m |                              |                                    |
| <b>B.3 Rail track</b>                                |                              |                                    |
| <b>B.3.1</b> Material                                |                              |                                    |
| <b>B.3.2 Slope</b>                                   |                              |                                    |
| <b>B.3.2.1</b> Percentage                            |                              |                                    |
| <b>B.3.2.2</b> Direction                             |                              |                                    |
| <b>B.3.3</b> Shape                                   |                              |                                    |
| <b>B.3.4</b> Number of rails                         |                              |                                    |
| <b>B.3.5</b> Maximum moving load capacity, kg/m      |                              |                                    |
| <b>B.3.6</b> Speed, m/s (if mechanized)              |                              |                                    |
| <b>B.3.6 Dimensions, mm</b>                          |                              |                                    |
| <b>B.3.6.1</b> Width                                 |                              |                                    |
| <b>B.3.6.2</b> Thickness                             |                              |                                    |
| <b>B.3.6.3</b> Diameter (if cylindrical)             |                              |                                    |
| <b>B.4 Corbel</b>                                    |                              |                                    |
| <b>B.4.1</b> Material                                |                              |                                    |
| <b>B.4.2</b> Dimensions, mm                          |                              |                                    |

| ITEMS  | Manufacturer's Specification | Verification by the Testing Agency |
|--|------------------------------|------------------------------------|
| <b>B.4.2.1</b> Height                            |                              |                                    |
| <b>B.4.2.2</b> Width                             |                              |                                    |
| <b>B.4.2.3</b> Thickness                         |                              |                                    |
| <b>B.4.3</b> Maximum tensile strength, kg        |                              |                                    |
| <b>B.5 Steel Support (if corbel is not used)</b> |                              |                                    |
| <b>B.5.1</b> Material                            |                              |                                    |
| <b>B.5.2 Dimensions, mm</b>                      |                              |                                    |
| <b>B.5.2.1</b> Height                            |                              |                                    |
| <b>B.5.2.2</b> Width                             |                              |                                    |
| <b>B.5.2.3</b> Thickness                         |                              |                                    |
| <b>B.5.3</b> Maximum tensile strength, kg        |                              |                                    |
| <b>B.6 Rail hangers</b>                          |                              |                                    |
| <b>B.6.1</b> Material                            |                              |                                    |
| <b>B.6.2</b> Hanger Spacing, mm                  |                              |                                    |
| <b>B.6.3 Dimensions, mm</b>                      |                              |                                    |
| <b>B.6.3.1</b> Width                             |                              |                                    |
| <b>B.6.3.2</b> Thickness                         |                              |                                    |
| <b>B.6.3.3</b> Diameter (if rod)                 |                              |                                    |
| <b>B.6.4</b> Maximum tensile strength, kg        |                              |                                    |
| <b>B.7 Rail switch track</b>                     |                              |                                    |
| <b>B.7.1</b> Material                            |                              |                                    |
| <b>B.7.2</b> Maximum load capacity, kg           |                              |                                    |
| <b>B.7.3 Dimensions, mm</b>                      |                              |                                    |
| <b>B.7.3.1</b> Width                             |                              |                                    |
| <b>B.7.3.2</b> Thickness                         |                              |                                    |
| <b>B.8 Track scale (if applicable)</b>           |                              |                                    |
| <b>B.8.1</b> Material                            |                              |                                    |
| <b>B.8.2</b> Brand                               |                              |                                    |
| <b>B.8.3</b> Type                                |                              |                                    |
| <b>B.8.4</b> Capacity, kg                        |                              |                                    |
| <b>B.8.5</b> Accuracy, kg                        |                              |                                    |
| <b>B.8.6</b> Location                            |                              |                                    |
| <b>B.8.7</b> Length, mm                          |                              |                                    |
| <b>B.9 Rail Stopper</b>                          |                              |                                    |
| <b>B.9.1</b> Material                            |                              |                                    |
| <b>B.9.2</b> # of unit                           |                              |                                    |
| <b>B.9.2 Dimensions, mm</b>                      |                              |                                    |
| <b>B.9.2.1</b> Width                             |                              |                                    |
| <b>B.9.2.2</b> Thickness                         |                              |                                    |
| <b>B.10 Prime mover (if applicable)</b>          |                              |                                    |
| <b>B.10.1 Electric motor</b>                     |                              |                                    |
| <b>B.10.1.1</b> Brand                            |                              |                                    |
| <b>B.10.1.2</b> Make                             |                              |                                    |
| <b>B.10.1.3</b> Serial Number                    |                              |                                    |
| <b>B.10.1.4</b> Type                             |                              |                                    |
| <b>B.10.1.5</b> Rated Power, kW                  |                              |                                    |

|                                  |  |  |
|----------------------------------|--|--|
| <b>B.10.1.6</b> Rated Speed, rpm |  |  |
| <b>B.10.1.7</b> Frequency, Hz    |  |  |
| <b>B.10.1.8</b> Voltage          |  |  |

**Annex C**  
(informative)

**Performance Test Data Sheet**

Test Engineer: \_\_\_\_\_ Date: \_\_\_\_\_  
 Assistants: \_\_\_\_\_ Location: \_\_\_\_\_  
 Test Location: \_\_\_\_\_  
 Test Requested by: \_\_\_\_\_  
 Manufacturer: \_\_\_\_\_

|   |  |
|---|--|
| <b>C.1 Information on the Test Materials</b>  |  |
| C.1.1 Weight, kg                              |  |
| C.1.2 Material                                |  |
| <b>C.1.3 Dimensions, mm</b>                   |  |
| C.1.3.2 Length, mm                            |  |
| C.1.3.3 Width, mm                             |  |
| C.1.3.4 Thickness, mm                         |  |
| C.1.3.5 Diameter, mm (if particular)          |  |
| C.1.4 Quantity                                |  |
| <b>C.2 Results of Performance Test</b>        |  |
| <b>C.2.1 Manual/Semi-Mechanized</b>           |  |
| <b>C.2.1.1 Noise Level, dB(A)</b>             |  |
| C.2.1.1.1 Without load                        |  |
| C.2.1.1.2 With load                           |  |
| <b>C.2.1.2 Welding Acceptance test</b>        |  |
| C.2.1.2.1 Crack prohibition                   |  |
| C.2.1.2.2 Weld/base-metal fusion              |  |
| C.2.1.2.3 Crater cross section                |  |
| C.2.1.2.4 Weld profile                        |  |
| C.2.1.2.5 Time of inspection                  |  |
| C.2.1.2.6 Undersize welds (if any)            |  |
| C.2.1.2.7 Undercut                            |  |
| C.2.1.2.8 Porosity                            |  |
| <b>C.2.1.3 Lowerator (if semi-mechanized)</b> |  |
| <b>C.2.1.3.1 Speed, rpm</b>                   |  |
| C.2.1.3.1.1 Without load                      |  |
| C.2.1.3.1.2 With load                         |  |
| C.2.1.3.2 Horizontal displacement, mm         |  |
| <b>C.2.1.4 Spreader (if semi-mechanized)</b>  |  |
| <b>C.2.1.4.1 Speed, rpm (if motorized)</b>    |  |
| C.2.1.4.1.1 Without load                      |  |
| C.2.1.4.1.2 With load                         |  |
| <b>C.2.1.4.2 Pressure, psi (if pneumatic)</b> |  |
| C.2.1.4.2.1 Without load                      |  |

|   |                             |  |
|---|-----------------------------|--|
| C.2.1.4.2.2                                   | With load                   |  |
| C.2.1.4.3                                     | Length, mm                  |  |
| <b>C.2.2 Mechanized</b>                       |                             |  |
| <b>C.2.2.1 Speed of Components, rpm</b>       |                             |  |
| <b>C.2.2.1.1 Electric Motor</b>               |                             |  |
| C.2.2.1.1.1                                   | Without load                |  |
| C.2.2.1.1.1                                   | With load                   |  |
| <b>C.2.2.1.2 Reducer Shaft</b>                |                             |  |
| C.2.2.1.2.1                                   | Without load                |  |
| C.2.2.1.2.2                                   | With load                   |  |
| <b>C.2.2.1.3 Trolley Speed</b>                |                             |  |
| C.2.2.1.3.1                                   | Without load                |  |
| C.2.2.1.3.2                                   | With load                   |  |
| <b>C.2.2.2 Noise Level, dB(A)</b>             |                             |  |
| C.2.2.2.1                                     | Without load                |  |
| C.2.2.2.2                                     | With load                   |  |
| <b>C.2.2.3 Power Consumption</b>              |                             |  |
| <b>C.2.2.3.1 Power, kW</b>                    |                             |  |
| C.2.2.3.1.1                                   | Without load                |  |
| C.2.2.3.1.2                                   | With load                   |  |
| <b>C.2.2.3.2 Voltage, V</b>                   |                             |  |
| C.2.2.3.2.1                                   | Without load                |  |
| C.2.2.3.2.2                                   | With load                   |  |
| <b>C.2.2.3.3 Current, A</b>                   |                             |  |
| C.2.2.3.3.1                                   | Without load                |  |
| C.2.2.3.3.1                                   | With load                   |  |
| <b>C.2.2.4 Welding Acceptance test</b>        |                             |  |
| C.2.2.4.1                                     | Crack prohibition           |  |
| C.2.2.4.2                                     | Weld/base-metal fusion      |  |
| C.2.2.4.3                                     | Crater cross section        |  |
| C.2.2.4.4                                     | Weld profile                |  |
| C.2.2.4.5                                     | Time of inspection          |  |
| C.2.2.4.6                                     | Undersize welds (if any)    |  |
| C.2.2.4.7                                     | Undercut                    |  |
| C.2.2.4.8                                     | Porosity                    |  |
| <b>C.2.2.5 Lowerator</b>                      |                             |  |
| <b>C.2.2.5.1 Speed, rpm</b>                   |                             |  |
| C.2.2.5.1.1                                   | Without load                |  |
| C.2.2.5.1.2                                   | With load                   |  |
| C.2.2.5.2                                     | Horizontal displacement, mm |  |
| <b>C.2.2.6 Spreader (if semi-mechanized)</b>  |                             |  |
| <b>C.2.2.6.1 Speed, rpm (if motorized)</b>    |                             |  |
| C.2.2.6.1.1                                   | Without load                |  |
| C.2.2.6.1.2                                   | With load                   |  |
| <b>C.2.2.6.2 Pressure, psi (if pneumatic)</b> |                             |  |
| C.2.2.6.2.1                                   | Without load                |  |
| C.2.2.6.2.2                                   | With load                   |  |
| C.2.2.6.3                                     | Length, mm                  |  |

**C.3 Overhead raiiling performance**

|                                | Static | Dynamic |
|--------------------------------|--------|---------|
| <b>C.3.1 Load capacity, kg</b> |        |         |
| C.3.1.1 Rail hanger            |        |         |
| C.3.1.2 Rail track             |        |         |
| C.3.1.3 Trolley                |        |         |
| C.3.1.4 Chain                  |        |         |
| C.3.1.5 Vibration, Hz          |        |         |
| C.3.2 Traveling                |        |         |
| <b>C.3.3 Failure</b>           |        |         |
| C.3.3.1 Sagging*               |        |         |
| C.3.3.2 Fracture*              |        |         |

\* Yes/No

**C.4 Rate the following observations:**

| ITEMS  | RATINGS** |
|--|-----------|
| C.4.1 Ease of loading                          |           |
| C.4.2 Ease of unloading                        |           |
| C.4.3 Ease of cleaning parts                   |           |
| C.4.4 Ease of adjusting and repair of parts    |           |
| C.4.5 Ease of collecting output                |           |
| C.4.6 Uniform travel of trolley along the rail |           |
| C.4.7 Safety                                   |           |
| C.4.8 Vibration                                |           |

\*\* 1 - Very Good  
 2 - Good  
 3 - Satisfactory  
 4 - Poor  
 5 - Very Poor

**C.5 Other Observations:**

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**Annex D**  
(informative)

**Formula Used During Calculations and Testing**

**D.1 Percent Speed Reduction (for mechanized type of rail system)**

$$R_S = \left( 1 - \frac{S_2}{S_1} \right) \times 100$$

where:

$R_S$  = Percent speed reduction, %

$S_1$  = Speed of the conveyor without load, m/s

$S_2$  = Speed of the conveyor with load, m/s

**D.2 Electrical energy consumption (for mechanized type of rail system)**

$$E_c = P_c T_o$$

where:

$E_c$  = Electric energy consumption, kW-h

$P_c$  = Power consumed, kW

$T_o$  = Time of operation, h

**D.3 Rail Slope**

$$S = \frac{Rise}{Run} \times 100$$

where:

$Rise$  = Vertical distance between ends of the rail, expressed in meter

$Run$  = Distance between ends of the rail measured horizontally, expressed in meter

#### D.4 Tensile Stress

$$\sigma = \frac{P}{A}$$

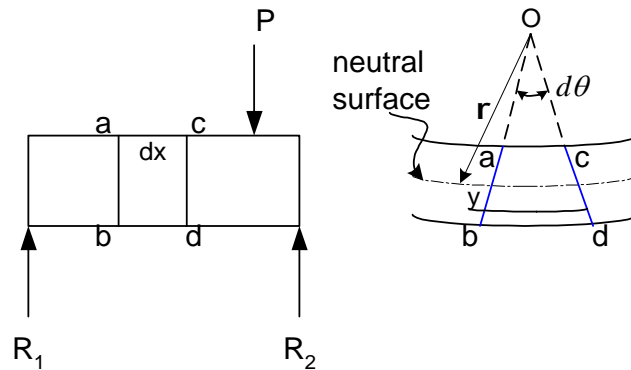
where:

$\sigma$  = Average normal stress at any point on the cross-sectional area

$P$  = Internal resultant normal force, which is applied through the centroid of the cross-sectional area

$A$  = Cross-sectional area of the bar

#### D.5 Bending/Flexural Stress



$$\sigma = \frac{My}{I}$$

the Flexure formula that relates the flexure stress with the bending moment

where:

$\sigma$  = Bending/Flexural stress

$M$  = Bending moment at a given point in the beam

$y$  = Distance of fiber from the neutral axis

$I$  = Moment of inertia of the cross-sectional area of the beam with respect to the neutral axis



$$\max \sigma = \frac{Mc}{I} \quad \text{or} \quad \max \sigma = \frac{M}{S} \quad S = \frac{I}{c}$$

where:

$c$  = distance of the far most fiber from the neutral axis

$S$  = section modulus of the cross-section