



# DMV 29.7

## 1. Applications

DMV 29.7 is high-alloy duplex (austenitic-ferritic) stainless steel developed for process environments associated with urea and carbamate production.

Manufactured in straight or U bent forms for urea plant condensers/scrubbers or stripper tubes and associated process piping and environments where high resistance to pitting and crevice corrosion is required. Other environments include caustic soda and nitric acid applications.

DMV 29.7 complements our existing grade DMV 25.22.2.

Carbon <b>C</b> ≤ 0.030	Chromium <b>Cr</b> 29	Nickel <b>Ni</b> 7	
Molybdenum <b>Mo</b> 2.3	Nitrogen <b>N</b> 0.35	Copper <b>Cu</b> <0.80	
Manganese <b>Mn</b> 1.0	Silicon <b>Si</b> 0.3	Phosphorus <b>P</b> ≤ 0.030	Sulphur <b>S</b> ≤ 0.030

Chemical composition nominal wt-%

## 2. Main Features

The grade demonstrates:

- Excellent resistance to intergranular corrosion
- Excellent resistance to pitting and crevice corrosion
- High resistance to stress corrosion cracking (SCC)
- Good corrosion resistance to carbamate solutions both with oxygen and with little or no oxygen
- Good weldability and formability

## 3. Description

### 3.1 Chemical Composition

DMV 29.7 typical values:

	% min.	%max.
<b>C</b>		0.030
<b>Mn</b>	0.80	1.50
<b>P</b>		0.030
<b>S</b>		0.030
<b>Si</b>		0.80
<b>Ni</b>	5.8	7.5
<b>Cr</b>	28.0	30.0
<b>Mo</b>	1.50	2.60
<b>N</b>	0.30	0.40
<b>Cu</b>		0.80
<b>Fe</b>	Balance	

weight%

### 3.2 Reference Standards

- UNS: S32906
- EN 1.4477
- Seamless tube and pipe acc to: ASTM A789 / ASTM A790
- ASME Code Case 2295-3

### 3.3 Mechanical Properties

The following figures apply to material in the solution annealed condition. If DMV 29.7 is exposed for extended periods in temperature ranges exceeding 280°C (540°F), the microstructure changes, which results in a reduction in toughness.

#### 3.3.1 Mechanical Properties at 20°C (68°F)

Wall thickness	Yield strength		Tensile strength		Elong.
	R <sub>p0.2</sub>	R <sub>m</sub>	R <sub>m</sub>	R <sub>m</sub>	
mm	MPa	ksi	MPa	ksi	%
	min.	min.	min.	min.	min.
<10	650	94	800	116	25
≥ 10	550	80	750	109	25

Elongation in 2 in. or 50 mm, min %

### 3.3.2 Hardness

DMV 29.7 has hardness max Rockwell 32HRC, Brinell 300HBW and Vickers 300HV (where Vickers testing is permitted on tubing less than 0.354 in. (9.0 mm) in inside diameter and tubing less than 0.065 in. (1.65 mm) wall thickness.

### 3.4 Physical Properties

Density	
g/cm <sup>3</sup>	lbs / in <sup>3</sup>
7.7	0.28

### 3.5 Corrosion Properties

#### 3.5.1 General Corrosion and Microstructure

DMV 29.7 demonstrates excellent corrosion resistance properties. This originates from the high content of alloying elements, low impurity content and control of heat treatment during the production process to ensure absence of detrimental precipitates and intermetallic phases.

DMV 29.7 has a duplex (austenitic-ferritic) structure with a ferrite content in the range 40-60%. The microstructure is free of detrimental intermetallic phases.

### 3.5.2 Intergranular Corrosion

DMV 29.7 demonstrates excellent resistance to intergranular corrosion and exceeds compliance with typical norms of either the Huey test (ASTM A262 practice C, 5 x 48h in boiling HNO<sub>3</sub>) or Streicher testing (ASTM A262 practice B, 120h in boiling H<sub>2</sub>SO<sub>4</sub> + FeSO<sub>4</sub>).

### 3.5.3 Stress Corrosion Cracking

DMV 29.7 demonstrates excellent resistance to chloride induced stress corrosion cracking (SCC).

### 3.5.4 Pitting and Crevice Corrosion

The optimised balance of high chromium content, nitrogen and molybdenum provides a high level of resistance to localised corrosion such as pitting and crevice corrosion.

## 4. Supply Range

### 4.1 Dimensional Range

DMV 29.7 is produced in seamless tubes, pipes and hollow bar in the size range:

Nominal Dimensional Range		
Cold Finished		
<b>Outside Diameter</b>	mm	inch
<b>min</b>	1.6	0.063
<b>max</b>	244.5	9.626
<b>Wall Thickness</b>	mm	inch
<b>min</b>	0.1	0.004
<b>max</b>	40	1.575
Hot Finished		
<b>Outside Diameter</b>	mm	inch
<b>min</b>	32	1.260
<b>max</b>	280	11.024
<b>Wall Thickness</b>	mm	inch
<b>min</b>	2.8	0.110
<b>max</b>	60	2.362

Specific dimensions by grade available upon request.

While our Company has compiled and organized this data to the best of its knowledge, the data is provided on an "as is" basis only. To the fullest extent permissible by applicable law, we neither make any representation nor give any warranty -neither express, implied or statutory- regarding this data, including, but not limited to, with respect to completeness, accuracy, reliability, security, timeliness, fitness or suitability for any particular purpose, merchantability or any decisions you may make based on it. To the same extent, our company does not assume any other liability regarding this data for any direct, indirect or consequential or any other losses or damages of whatsoever kind (whether based on contract, tort, delict, warranty or any other legal theory) resulting from its use. The use of this data is at your own risk, unless otherwise agreed in writing. Our company reserves the right to modify its content at its own discretion at any time and without prior notice."

## 4.2 Delivery Condition

Pipes and tubes are delivered in cold or hot finished condition depending on size and specification. Normally they will be supplied in annealed condition.

### 4.3 U-bent

Tubes for urea application are also available in U-bent version in lengths of up to 30m (straight). The high deformability of the material allows cold bending down to a very small bending radius.

## 5. Fabrication

### 5.1 Heat Treatment

Pipes and tubes are delivered in the annealed condition. In case a subsequent processing requires an additional heat treatment, this has to be performed at 1080 - 1140°C (1976 - 2085°F) followed by rapid cooling in air or water.

This is especially recommended when the steel has been exposed in temperature ranges 350 - 525°C (662 - 977°F) and 600 - 950°C. (1112 - 1742°F) for a long duration causing embrittlement and reduced corrosion resistance.

### 5.2 Expanding

DMV 29.7 tubes and pipes can be expanded similarly to austenitic stainless steels, bearing in mind, however, their greater strength. "Close fit" clearance per TEMA is recommended.

### 5.3 Bending

#### Cold

Despite their greater strength, during bending DMV 29.7 tubes behaves similarly to austenitic steels. When plastic deformation exceeds 25%, subsequent heat treatment is necessary.

#### Hot

Bending is possible in the range 950 - 1000°C (1742 - 1832°F) and must be followed by rapid cooling. It should, however, be noticed that the strength of DMV 29.7 is low at high temperatures which can have a negative influence on the final shape.

### 5.4 Cutting and Machining

A higher wear rate of the tools than that of austenitic steels can be noticed when cutting and machining of DMV 29.7 due to the higher hardness.

### 5.5 Welding

DMV 29.7 has a good weldability. Welding is possible with all processes usual for stainless steels. Preheating and heat treatment after welding is normally not necessary.

Butt welding or welding to tube plate is carried out using the gas tungsten arc welding process (TIG / GTAW) with a filler metal having a similar composition (PREN > 41) enriched with elements to favour austenite formation. Use moderate heat input in the range of 10 to 25 kJ / cm.

In all cases it is imperative to remove all traces of superficial oxidation which might initiate localised attack.

## 6. Standards and References

DMV 29.7 is delivered in accordance with European, American, other international standards and following specific requirements of individual customers.