# Technical Specifications

## Stainless Steel Reinforcement

ARMINOX® Stainless

# Available Commercial Grades (EN 10088-1:2005)

| Steel Designation (Eurocode) | | | Chemical Composition | | | |
|---|---|---|---|---|---|---|
| **Number** | **Name** | **Microstructure** | **C** | **Si** | **Mn** | **P** |
| 1.4301 | X5CrNi18-10 | Austenitic | ≤ 0,07 | ≤ 1,00 | ≤ 2,00 | ≤ 0,045 |
| 1.4436 | X3CrNiMo17-13-3 | Austenitic | ≤ 0,05 | ≤ 1,00 | ≤ 2,00 | ≤ 0,045 |
| 1.4571 | X6CrNiMo17-12-2 | Austenitic | ≤ 0,08 | ≤ 1,00 | ≤ 2,00 | ≤ 0,045 |
| 1.4362 | X2CrNiN23-4 | Duplex | ≤ 0,030 | ≤ 1,00 | ≤ 2,00 | ≤ 0,035 |
| 1.4462 | X2CrNiMoN22-5-3 | Duplex | ≤ 0,030 | ≤ 1,00 | ≤ 2,00 | ≤ 0,035 |

(Other grades can be made available upon request)

| Chemical Composition | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S** | **N** | **Cr** | **Cu** | **Mo** | **Nb** | **Ni** | **Others** |
| ≤ 0,030 | ≤ 0,11 | 17,5 to 19,5 | - | - | - | 8,0 to 10,5 | - |
| ≤ 0,030 | ≤ 0,11 | 16,5 to 18,5 | - | 2,50 to 3,00 | - | 10,5 to 13,0 | - |
| ≤ 0,030 | - | 16,5 to 18,5 | - | 2,00 to 2,50 | - | 10,5 to 13,5 | Ti: 5xC to 0,70 |
| ≤ 0,015 | 0,05 to 0,20 | 22,0 to 24,0 | 0,10 to 0,60 | 0,10 to 0,60 | - | 3,5 to 5,5 | - |
| ≤ 0,015 | 0,10 to 0,22 | 21,0 to 23,0 | - | 2,50 to 3,50 | - | 4,5 to 6,5 | - |

# Corresponding Steel Designations (Including Former Designations)

| Steel Designation (Eurocode) | | USA | | UK | Germany |
|---|---|---|---|---|---|
| **Number** | **Name** | **AISI/SAE** | **ASTM/ASME** | **BS** | **DIN** |
| 1.4301 | X5CrNi18-10 | 304 | UNS S30400 | 304 S11 | W.Nr.1.4301 |
| | | 304H | | 304 S15 | X 5 CrNi 18-10 |
| | | 304N | | 304 S16 | (X 4 CrNi 18 10) |
| | | | | 304 S17 | |
| | | | | 304 S31 | |
| | | | | LW 21 | |
| | | | | LWCF 21 | |
| 1.4436 | X3CrNiMo17-13-3 | 316 | UNS S31600 | 316 S33 | W.Nr.1.4436 |
| | | | | | X 3 CrNiMo 17-13-3 |
| | | | | | (X 5 CrNiMo 17-13-3) |
| | | | | | |
| 1.4571 | X6CrNiMo17-12-2 | 316Ti | UNS S31635 | 320 S18 | W.Nr.1.4571 |
| | | | | 320 S31 | X6CrNiMoTi17-12-2 |
| 1.4362 | X2CrNiN23-4 | SAF 2304 | UNS S32304 | - | W.Nr.1.4362 |
| | | "2304" | | | X 2 CrNiN 23-4 |
| 1.4462 | X2CrNiMoN22-5-3 | "2205" | UNS S32205 | 318 S13 | W.Nr.1.4462 |
| | | | | | X2CrNiMoN22-5-3 |

| France | Italy | Japan | Sweden | Russia | Spain |
|---|---|---|---|---|---|
| **AFNOR** | **UNI** | **JIS** | **SS** | **GOST** | **UNE** |
| Z 4 CN 19-10 FF | X 5 CrNi 18 10 | SUS 304 | 2332 | 08 Ch18N10 | F.3504 |
| Z 5 CN 17-08 | | | 2333 | | X 5 CrNi 18 10 |
| Z 6 CN 18-09 | | | | | |
| Z 7 CN 18-09 | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Z 6 CND 18-12-03 | X 5 CrNiMo 17 13 | SUS 316 | 2343 | EA-1M2 | F.3534 |
| Z 7 CND 18-12-03 | X 8 CrNiMo 17 13 | | | | X 5 CrNiMo 17 12 2 |
| | | | | | F.3538 |
| | | | | | X 5 CrNiMo 17 13 3 |
| Z 6 CNDT 17-12 | X 6 CrNiMo 17 12 | SUS 316 Ti | 2350 | 10Ch17N13M2T | F.3535 |
| | | | | | X 6 CrNiMoTi |
| Z 3 CN 23.04 Az | - | - | - | - | - |
| - | - | - | - | - | - |
| Z 3 CND 22-05 Az | - | SUS 329 J3L | 2377 | - | - |
| (Z 3 CND 25-06-03 Az) | - | - | - | - | - |

# Delivery Data

| Steel Designation | Production Method | Available Dimensions | Delivery Method | | | Arminox Bar Identification |
|---|---|---|---|---|---|---|
| **Number** | | **mm** | **Coils** | **Bars** | **Stirrups** | |
| 1.4301 | Cold worked | 3-16 mm | Max 2000 kg | Max 12000 mm | Standard | /////VV//// |
| 1.4436 | Cold worked | 3-16 mm | Max 2000 kg | Max 12000 mm | shapes (see | /////VVV//// |
| 1.4571 | Cold worked | 3-16 mm | Max 2000 kg | Max 12000 mm | page 9-11) | ////X///X///X//// |
| 1.4362 | Cold worked | 6-12 mm | Max 2000 kg | Max 12000 mm | or according | ////X///X///X˙//// |
| 1.4301 | Hot rolled | 20-50 mm | N/A | Max 12000 mm | to client | Varying |
| 1.4462 | Hot rolled | 20-40 mm | N/A | Max 11700 mm | drawing | Varying |

| Nominal size | Nominal weight per meter run* | Nominal size | Nominal weight per meter run* |
|---|---|---|---|
| 3 mm | 0,056 kg | 14 mm | 1,224 |
| 4 mm | 0,100 kg | 16 mm | 1,598 |
| 5 mm | 0,156 kg | 20 mm | 2,498 |
| 6 mm | 0,225 kg | 25 mm | 3,902 |
| 7 mm | 0,306 kg | 32 mm | 6,393 |
| 8 mm | 0,400 kg | 40 mm | 9,990 |
| 10 mm | 0,624 kg | 50 mm | 15,602 |
| 12 mm | 0,899 kg | | |

*Density 7950 kg/m$^3$

# Mechanical Properties

According to: Danish Standard - DS 13080 · British Standard BS 6744 & BS 8666 · German Zulassung Z-1.4-80.

| Specified Standard | 0,2% Proof Strength $R_{PO,2}$ | Ultimate Tensile Strength $R_M$ | Stress Ratio $R_M/R_{PO,2}$ | Elongation $A_J$ | Total Elongation at max. Force $A_{gt}$ | Elongation at Fracture $A_5$ |
|---|---|---|---|---|---|---|
| | N/mm² | N/mm² | - | % | % | % |
| Danish Standard | ≥ 550 | - | ≥ 1,08 | ≥ 8 | - | - |
| British Standard | ≥ 550 | - | ≥ 1,10 | - | ≥ 5,0 | ≥ 14,0 |
| German Zulassung | ≥ 500 | ≥ 550 | ≥ 1,08 | - | ≥ 5,0 | - |

# Physical Properties

| Steel Designation | PREN Value | Modulus of Elastiticy at 20° C | Mean Coefficient of Thermal Expansion between 20-100°C | Thermal Conductivity at 20°C | Specific Thermal Capacity 20°C | Electrical Resistivity at 20°C |
|---|---|---|---|---|---|---|
| Number | | GPa | $10^{-6}K^{-1}$ | W/m·K | J/kg·K | Ω·mm²/m |
| 1.4301 | 18 | 200 | 16,0 | 15 | 500 | 0,73 |
| 1.4436 | 26 | 200 | 16,0 | 15 | 500 | 0,75 |
| 1.4571 | 25 | 200 | 16,5 | 15 | 500 | 0,75 |
| 1.4362 | 24 | 200 | 13,0 | 15 | 500 | 0,8 |
| 1.4462 | 36 | 200 | 13,0 | 15 | 500 | 0,8 |

# Arminox Guide to Choice of Stainless Steel Reinforcement

| Environment class | Aggressiveness | Recommended Reinforcement Steel |
|---|---|---|
| Passive | | High yield reinforcement steel |
| Moderate | | High yield reinforcement steel / 1.4301 |
| Aggressive | Low | 1.4301 |
| | Medium | 1.4436/1.4362 |
| | High | 1.4462 |
| Extra aggressive | | Super austenitic / super duplex |

# Definition of an Aggressive Environment

| Environment | Example | Effect |
|---|---|---|
| Low | Inland industrial areas | Carbonatisation |
| Medium | Marine and coastal areas | Chloride penetration |
| | Road deicing salt | |
| High | Extreme temperature differences | Carbonatisation |
| | Extreme chloride concentrations | chloride penetration, other |
| | Extreme environmental conditions | |

# Standard Shapes According to BS 8666:2005

**For scheduling of stainless steel reinforcement. Drawings supplied by UK CARES**
**Shape and total length of bar (L) measured along centre-line.**

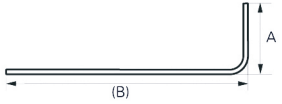
**00**


Total length (L) = A

**01**


Total length (L) = A, stock lengths

**11**

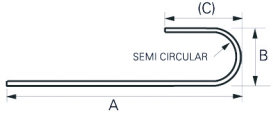



Total length (L) = A + (B) - 0.5r - d

**12**

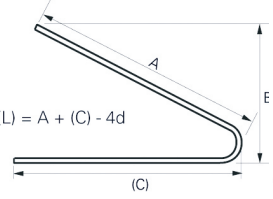

Total length (L) = A + (B) - 0.43R - 1.2d

**13**



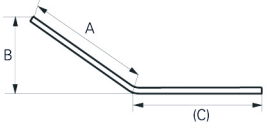

Total length (L) = A + 0.57B + (C) - 1.6d

**14**




Total length (L) = A + (C) - 4d

**15**

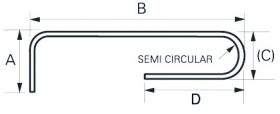



Total length (L) = A + (C)

**21**

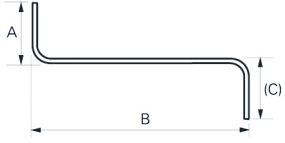

Total length (L) = A + B + (C) - r - 2d

**22**



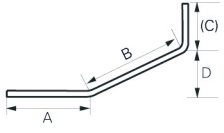

Total length (L) = A + B + C + (D) - 1.5r - 3d

**23**



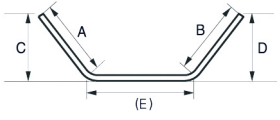

Total length (L) = A + B + (C) - r - 2d

**24**



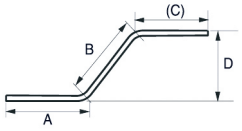

Total length (L) = A + B + (C)

**25**




Total length (L) = A + B + (E)

**26**




Total length (L) = A + B + (C)

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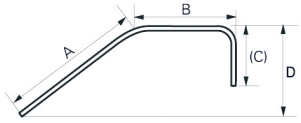
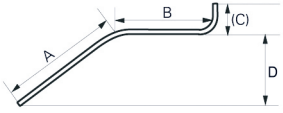


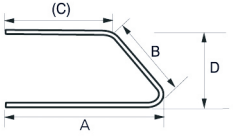

Total length (L) = A + B + (C) - 0.5r - d

**28**



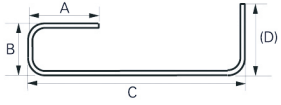

Total length (L) = A + B + (C) - 0.5r - d

**29**



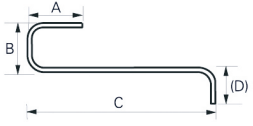

Total length (L) = A + B + (C) - r - 2d

**31**



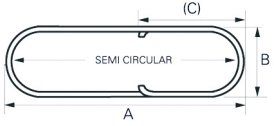

Total length (L) = A + B + C + (D) - 1.5r - 3d

**32**



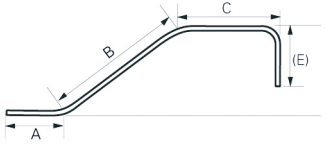

Total length (L) = A + B + C + (D) - 1.5r - 3d

**33**



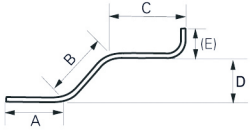

Total length (L) = 2A + 1.7B + 2(C) - 4d

**34**



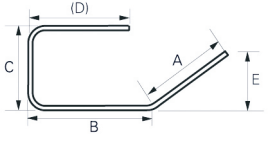

Total length (L) = A + B + C + (E) - 0.5r - d

**35**



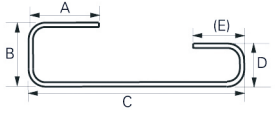

Total length (L) = A + B + C + (E) - 0.5r - d

**36**



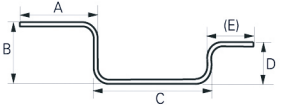

Total length (L) = A + B + C + (D) - r - 2d

**41**



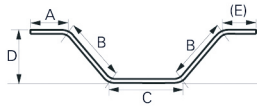

Total length (L) = A + B +C +D +(E) - 2r - 4d

**44**



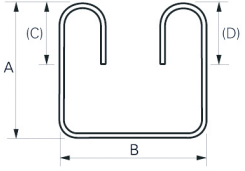

Total length (L) = A + B + C + D +(E) - 2r - 4d

**46**



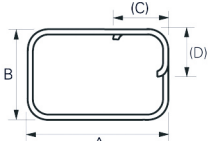

Total length (L) = A + 2 B + C + (E)

**47**



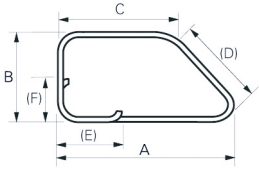

Total length (L) = 2A + B + 2C + 1.5r - 3d

**51**



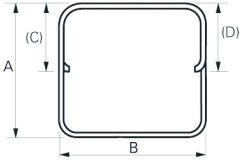

Total length (L) = 2(A + B + (C)) - 2.5r - 5d

**56**



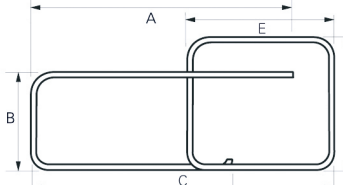

Total length (L) = A + B + C + (D) + 2(E) - 2.5r - 5d

**63**



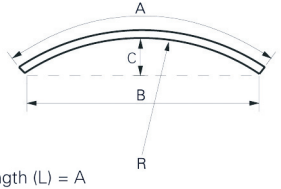

Total length (L) = 2A + 3B + 2(C) - 3r - 6d

**64**



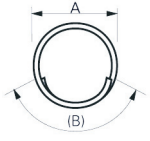

Total length (L) = A + B + C + 2D + E + (F) - 3r - 6d

**67**



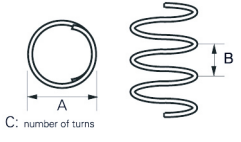

Total length (L) = A

**75**



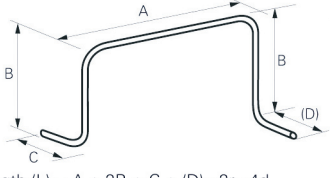

Total length (L) = $\pi$ (A - d) + B

**77**




Total length (L) = C.$\pi$.(A - d)

**98**




Total length (L) = A + 2B + C + (D) - 2r - 4d

**99** All other shapes where standard shapes cannot be used.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