

## Special structural steels for low-temperature service

Technical Gas	Main content	Boiling Temperature	Material
Liquefied Petroleum Gas (LPG)	propane / butane	-42°C / -0,5°C	Fine grain structural steels (N, M, Q, Re>460 MPa)
Liquefied Ethylene Gas (LEG)	ethylene	-104°C	5% Ni-Steel (ship tanks) 9% Ni-Steel (stationary tanks)
Liquefied Natural Gas (LNG)	methane	-162°C	9% Ni-Steel SS AISI 304 L (18% Cr, 8% Ni)

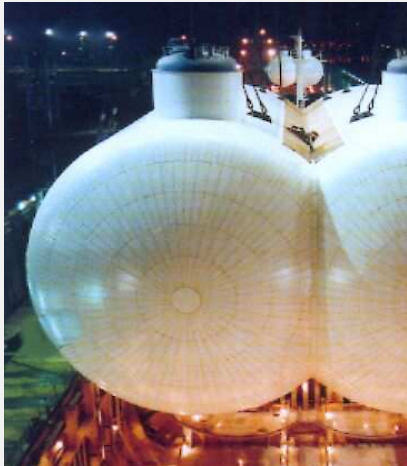
# Special structural steels for low-temperature service

EN 10028-4	ASTM Grades
13MnNi6-3	-
12Ni14	A 203 Grad D/E/F
X12Ni5 (12Ni19)	-
X7Ni9	A 353/A 553 Type 1
X8Ni9*	A 353/A 553 Type 1

\* available as NT640, QT640 and QT680-variant



# Special structural steel 12Ni5 for low-temperature service



- 5 % nickel steel for low temperature service for temperatures up to -110 °C
- Application for pressure vessels and tanks for the transportation and storage of ethylene
- Reference: 5.000 t/y in thicknesses up to 50 mm



- Heat treatment: quenched and tempered
- Mechanical properties:
  - Yield strength  $\geq 380$  MPa
  - Tensile strength: 530 - 710 MPa
  - CVN, long., -120 °C  $\geq 40$  J

# Special structural steel X8Ni9 for extremely low temperatures

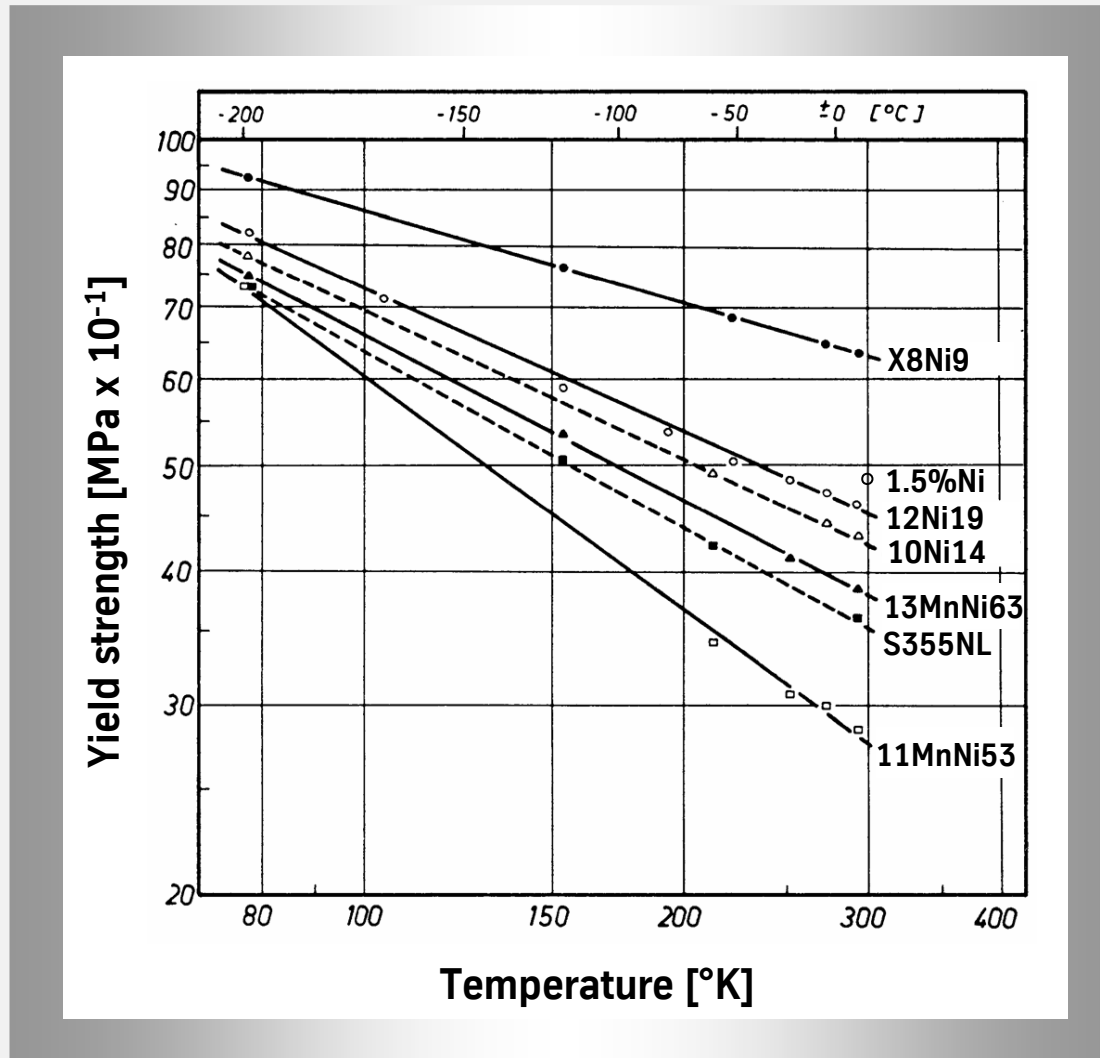


- 9 % nickel steel for extremely low temperature service up to - 196 °C
- Application for pressure vessels and tanks for the transportation and storage of liquefied natural gas
- 5.000 t/y in thicknesses up to 90 mm



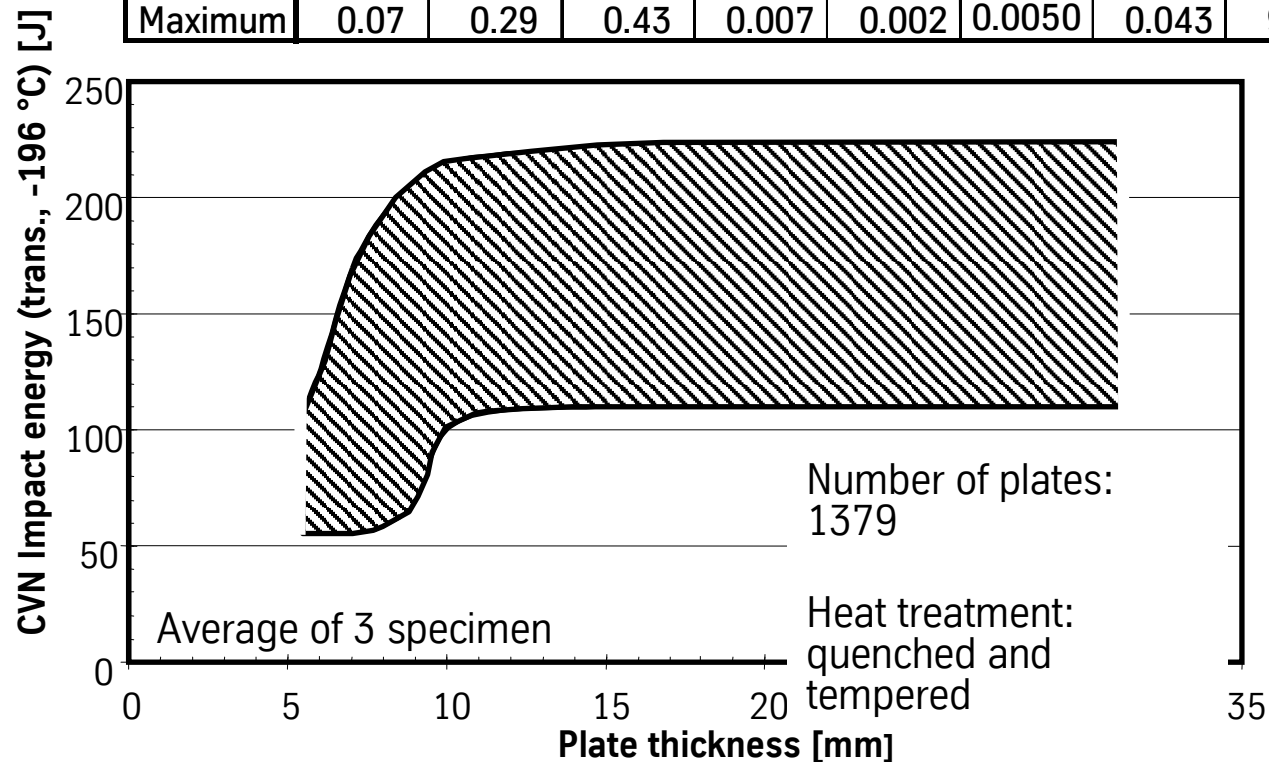
- Heat treatment: quenched and tempered
- Mechanical properties:
  - Yield strength  $\geq 490$  MPa
  - Tensile strength: 640 - 840 MPa
  - CVN, long., -196 °C  $\geq 50$ J

# Yield strength dependent on the temperature



# Typical mechanical properties of X8Ni9 (Q+T)

X8Ni9	Chemical composition (13 heats) [%]									Plate thickness [mm]
	C	Si	Mn	P	S	N	Al	Ni	Mo	
Minimum	0.06	0.18	0.36	0.005	< 0.001	0.0040	0.034	8.90	0.01	5.3
Maximum	0.07	0.29	0.43	0.007	0.002	0.0050	0.043	9.30	0.08	31.4



Typical values  
 $R_e$  690 MPa  
 $R_m$  740 MPa

# Rupture behaviour of a submerged arc weld joint of the low temperature steel X8Ni9 (Three-point bending test based on BS 5762)

