

Manauurite[®] XMR



MANOIR
A PARALLOY GROUP COMPANY

CHEMICAL COMPOSITION

Element	Minimum	Maximum
C	0.40	0.50
Mn	0.3	1.0
Si	0.6	1.2
Ni	32.0	35.0
Cr	23.0	27.0
Ti + others	Add	Add
Zr	Add	Add

(Typical composition, slight modifications can be carried out depending on the application).

PHYSICAL PROPERTIES

Specific gravity: 8.02 kg/dm³ (0.29 lb/inch³)
Melting point: 1 350°C (2 460°F)

Coefficient of expansion

Temperature range	mm/mm°C x 10 ⁻⁶ (in/in°F x 10 ⁻⁶)
From 20°C to 850°C (70°F to 1 560°F)	18.5 (10.21)
From 20°C to 950°C (70°F to 1 740°F)	18.9 (10.4)
From 20°C to 1 050°C (70°F to 1 920°F)	19.3 (10.6)
From 20°C to 1 150°C (70°F to 2 100°F)	19.7 (10.9)

Thermal conductivity

At 1 050°C (1922°F): 30 W/m.°C (17.34 BTU/h.ft.°F)

At 20°C (77°F): 10.5 W/m.°C (6.07 BTU/h.ft.°F)

Specific heat

°C	°F	Cal/g.°C Or BTU/lb.°F	J/kg.°C
20	68	0.112	469
100	212	0.117	489.9
200	392	0.124	519.3
300	572	0.130	544.4
400	752	0.137	573.7
500	932	0.143	598.8
600	1 112	0.150	628.2
700	1 292	0.157	657.5
800	1 472	0.163	682.6
900	1 652	0.170	711.9
1 000	1 832	0.177	741.2
1 100	2 012	0.183	766.4
1 200	2 192	0.190	795.7

Modulus of elasticity

°C	°F	MPa	ksi
20	68	161 900	23 470
100	212	155 000	22 475
200	392	147 150	21 337
300	572	138 000	20 010
400	752	133 400	19 343
500	932	126 000	18 270
600	1 112	117 700	17 066
700	1 292	111 000	16 095
800	1 472	106 000	15 360
900	1 652	101 000	14 650
1 000	1 832	97 100	14 080
1 100	2 012	93 200	13 510

MECHANICAL PROPERTIES

1. At room temperature (minimum values)

Ultimate tensile strength:	450 MPa	65.000 psi
Yield strength:	250 MPa	35.500 psi
Elongation (on 4d):	8% for centrifugally cast pipes 6% for static castings	

2. Short time tensile tests at various temperatures on as cast material

Temperature		U.T.S.		Y.S.		E
°C	°F	MPa	ksi	MPa	ksi	%
750	1 380	333	48.4	157	22.8	16
800	1 470	265	38.2	147	21.3	20
850	1 560	196	28.4	137	19.9	22
900	1 650	147	21.3	118	17.1	30
950	1 740	118	17.1	88	12.8	32
1 000	1 830	93	13.5	78	11.4	38
1 050	1 920	74	10.7	69	10.0	47
1 100	2 010	61	8.8	55	8.0	39

(typical values)

3. Creep rupture stress in MPa

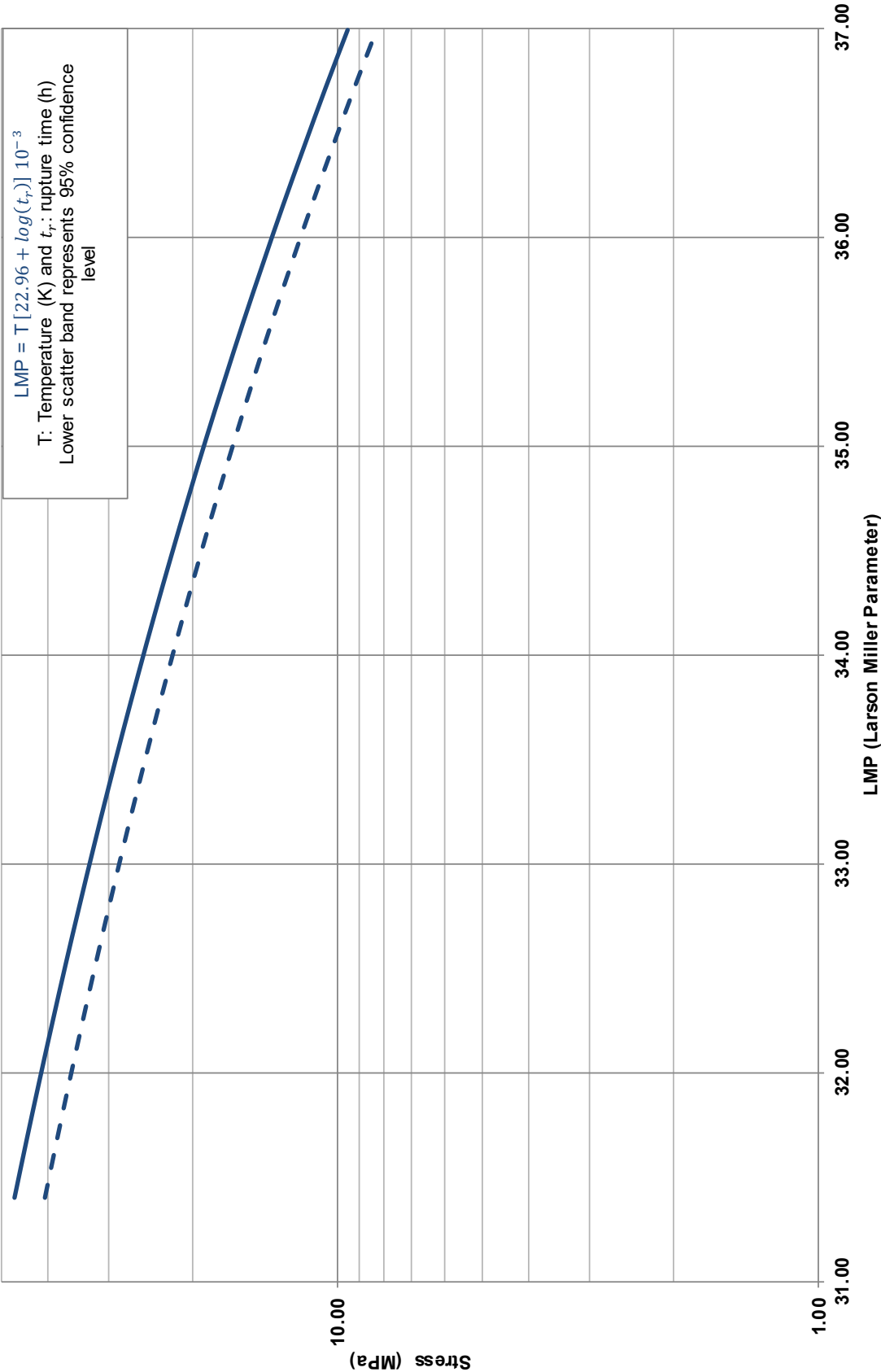
Manaurite® XMR: 100 000 hours

Temperature		Stress Min XMR (95% conf.)	Stress Avg XMR
°C	°F	MPa	MPa
850	1 562	40.60	46.92
860	1 580	38.31	44.25
870	1 598	36.09	41.66
880	1 616	33.94	39.15
890	1 634	31.86	36.74
900	1 652	29.85	34.40
910	1 670	27.92	32.15
920	1 688	26.05	29.99
930	1 706	24.26	27.91
940	1 724	22.54	25.91
950	1 742	20.89	24.00
960	1 760	19.31	22.17
970	1 778	17.80	20.43
980	1 796	16.36	18.78
990	1 814	15.00	17.20
1 000	1 832	13.71	15.72
1 010	1 850	12.48	14.31
1 020	1 868	11.33	13.00
1 030	1 886	10.25	11.76
1 040	1 904	9.25	10.62
1 050	1 922	8.31	9.55

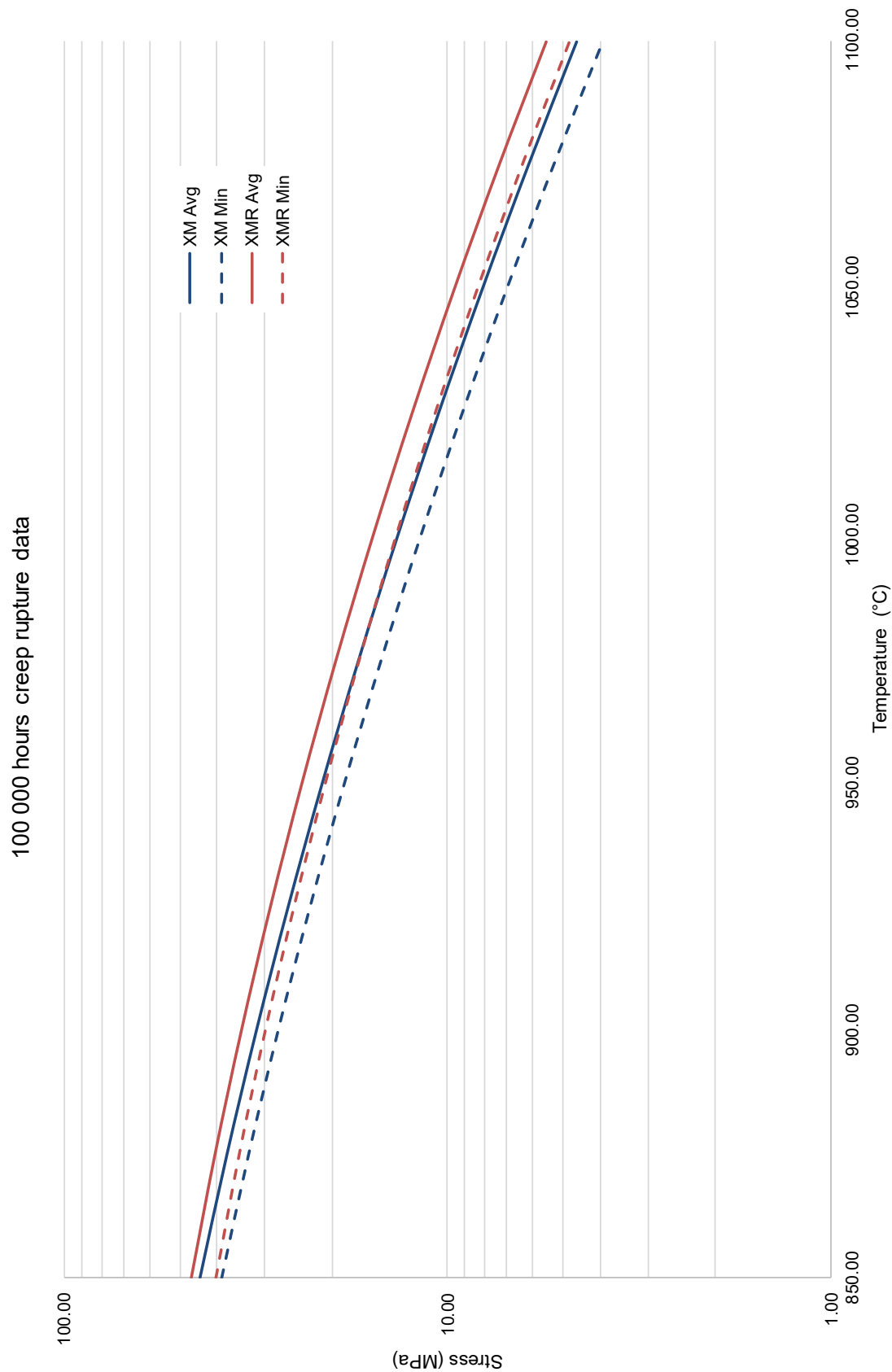
Manaurite® XMR: 200 000 hours

Temperature		Stress Min XMR (95% conf.)	Stress Avg XMR
°C	°F	MPa	MPa
850	1 562	37.84	43.70
860	1 580	35.61	41.10
870	1 598	33.45	38.58
880	1 616	31.37	36.16
890	1 634	29.36	33.83
900	1 652	27.42	31.57
910	1 670	25.55	29.41
920	1 688	23.76	27.33
930	1 706	22.04	25.34
940	1 724	20.40	23.43
950	1 742	18.82	21.61
960	1 760	17.32	19.88
970	1 778	15.89	18.23
980	1 796	14.54	16.68
990	1 814	13.26	15.20
1 000	1 832	12.05	13.82
1 010	1 850	10.91	12.52
1 020	1 868	9.85	11.30
1 030	1 886	8.86	10.18
1 040	1 904	7.94	9.14
1 050	1 922	7.10	8.19

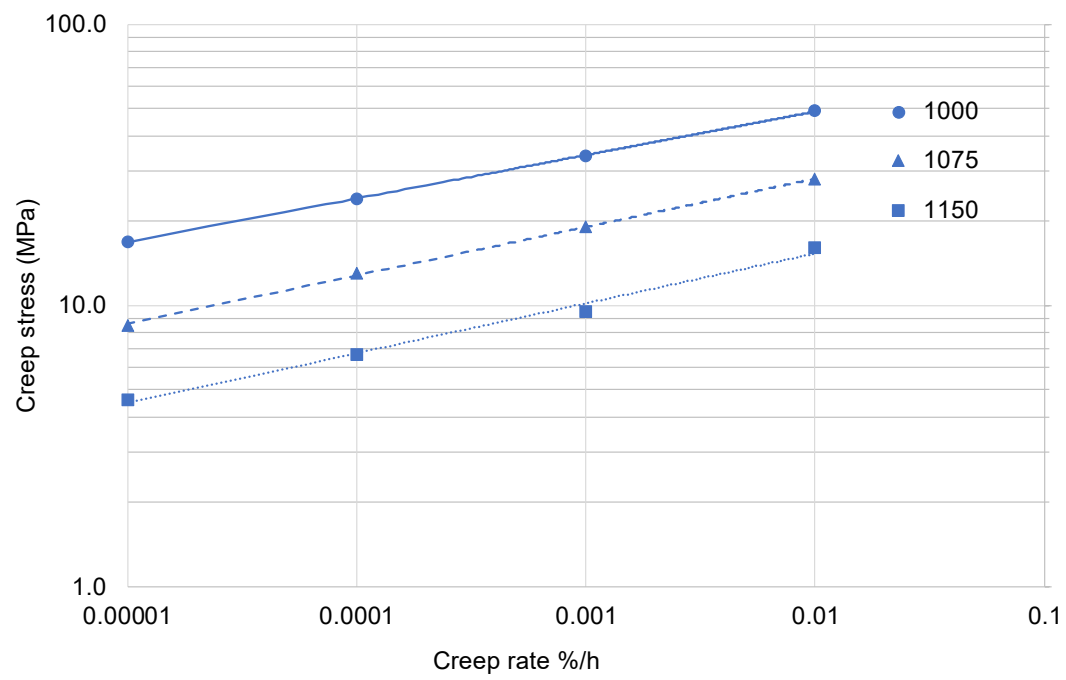
4. Creep rupture data (95% confidence level)



5. Comparative Maurantite® XMR vs Maurantite® XM



6. Creep rates - Manaurite® XMR



MANOIR FRANCE

Future is our raw material.

As a metal processing specialist, Manoir Industries develops alloys and operates processes for the manufacture of high-performance components. Known and recognised for several decades, its know-how is complemented by its expertise in casting, forging, boilermaking, welding and assembly. Manoir's solid technical expertise continues to drive its sustainable leading position, offering innovative services to its customers worldwide as a true partner.