Quality	**16NiCrMo12**	**Case-hardening Steel**	*Technical card*
According to standards	**UNI 7846: 1978**		***Lucefin Group***
Number			*rev. 2018*

Chemical composition

C%	**Si%**	**Mn%**	**P%** max	**S%** max	**Ni%**	**Cr%**	**Mo%**	
0,13-0,19	0,15-0,40	0,40-0,70	0,035	0,035	2,70-3,20	0,80-1,10	0,30-0,40	Product deviations are allowed
± 0.02	± 0.03	± 0.04	+ 0.005	+ 0.005	± 0.07	± 0.05	± 0.04	

Temperature °C

Hot-forming	**Normalizing +N**	**Core hardening**	**Carbonitriding**	**Carburizing**	**Hardening carburizing surf.**	**Str-reliev. +SR**
1100-900	840 air	820-850 oil-polymer salt bath		870-900	780-810 oil-polymer salt bath	150 200

Soft annealing +A	**Isothermal annealing +I**	**Spheroidizing +AC**	**End quench hardenability test**	**Pre-heating welding**		**Stress-relieving after welding**
				welding must be carried out on the annealed state and before carburizing		
680 furnace (HB max 250)	810 furnace cooling to 620, then air (HB 190-236)	-	850 water	150-350		600 furnace cooling
				Ac_1	**Ac_3**	**Ms** * core ** carburizing surface
				710	780	330* 150**

Mechanical properties

Hot-rolled values obtained on test blanks after core hardening + stress-relieving UNI 7846: 1978. Use only as reference

size	Testing at room temperature (longitudinal)						
mm	**R**	**Rp** 0.2	**A%**	**Z%**	**Kcu**	***HB***	
test blanks	N/mm²	N/mm² min.	min.	min.	J min.		
11	1230-1520	980	9	-	32.5	*363-432*	
30	1080-1370	785	10	-	35	*327-394*	for information only
63	980-1270	735	10	-	42.5	*295-373*	for information only

Table of tempering values obtained at room temperature on rounds of Ø 10 mm after quenching oil at 840 °C

HB		426	421	421	415	409	404	385	381	357	327	301	271	250
HRC		45.5	45	45	44.5	44	43.5	42.5	41	38.5	35	32	28	24.5
R	N/mm²	1490	1480	1470	1460	1440	1420	1360	1300	1200	1090	1000	910	840
Rp 0.2	N/mm²		1300	1320	1330	1320	1300	1260	1200	1140	1050	960	830	720
A	%	12.0	12.0	11.8	11.2	10.4	10.0	10.6	11.5	12.8	14.6	16.8	20.0	21.8
Z	%	50	52	55	55	56	56	56	56	57	59	63	67	69
Kv	J	42	43	46	66	66	46	42	42	46	76	100	128	126
HRC carburizing		65	64.5	64	62	59	57	-	-	-	-	-	-	-
Tempering at **°C**		**50**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**

16NiCrMo12

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Cold-drawn						Hot-rolled **Peeled**			
size mm		Testing at room temperature				Testing at room temperature			
		R	**Rp** 0.2	**A**%	**HB**	**R**	**Rp** 0.2	**A**%	**HB**
from	to	N/mm²	N/mm² min	min		N/mm²	N/mm² min	min	
No indications from reference standards						No indications from reference standards			

Forged UNI 8550: 1984. Use only as reference

size mm		Testing at room temperature					
		R	**Rp** 0.2	**A%**	**Kcu**	***HRC***	***HB***
from	to	N/mm²	N/mm² min	min (L)	J min (L)	*for information*	
	11	1225-1520	980	8	32.5	*39-46*	*361-432*
11	25	1130-1500	835	9	35	*36.5-45.5*	*339-426*
25	40	1030-1325	735	10	37	*33-41.5*	*311-384*
40	100	930-1275	685	10	40	*29-40*	*278-373*
100	150	835-1130	635	11	40	*24.5-36.5*	*250-339*

Mechanical properties obtained on test blanks after core hardening + stressrelieving
L = longitudinal

UNI 7846: 1978 **Jominy test HRC** grain size 5 min.

mm distance from quenched end

	1.5	**3**	**5**	**7**	**9**	**11**	**13**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
min	42	41.5	41	40.5	40	39	38.5	38	36.5	35.5	34	33	32	31	30
max	48	48	48	47.5	47.5	47	47	46.5	45.5	44.5	44	43	42	41.5	41

Thermal Expansion	$10^{-6} \cdot K^{-1}$		
Mod. of Elasticity long.	GPa	210	
Mod. of Elasticity tang.	GPa	80	
°C		**20**	

EUROPE	**ITALY**	**CHINA**	**GERMANY**	**FRANCE**	**U.K.**	**RUSSIA**	**USA**
EN	UNI	GB	DIN	AFNOR	B.S.	GOST	AISI/SAE
14NiCrMo13-4	16NiCrMo12			16NCD13		16HN3M	9314