

## isovac 470-65 K HE

### The specialist for shorter final annealing times

Production in modern continuous annealing lines ensures that this semi-processed isovac® grade exhibits homogeneous mechanical and magnetic properties. High dimensional accuracy and defined degrees of roughness guarantee best punchability and further processing. isovac 470-65 K HE (high-efficiency) is highly decarbonized in as-delivered condition, which means that the final annealing time at the customer can be significantly shortened. Subsequent annealing at the customer for the purpose of adjusting optimum magnetic properties completely eliminates any mechanical damage introduced to the material during the punching process.

#### Convincing advantages:

- » Shorter final annealing made possible by the low carbon content and thus reduced overall costs resulting from lower energy input
- » Best processability through consistent mechanical properties and homogeneous, clean surfaces with defined roughness
- » Excellent stackability resulting from high dimensional accuracy (thickness tolerance)

voestalpine supplies isovac 470-65 K HE, an electrical steel of the highest quality. We offer you a customer-focused over-all package of products, service and logistics in addition to all the advantages of our integrated metallurgical facility and Steel Service Centers.

**Mechanical properties:**

Tensile test according to DIN EN ISO 6892-1 and hardness according to DIN EN ISO 6507-1 (Typical values);  
Test direction: Transverse

Grade named according to isovac®	0.2 %-Yield strength $R_{p0.2}$ [MPa]	Tensile strength $R_m$ [MPa]	Elongation $A_{80}$ [%]	Hardness HV5 [-]
isovac 470-65 K HE	450	490	18	185

**Magnetic properties:**

after final annealing according to EN 10341 (Typical values);  
Test direction: Mean value from longitudinal and transverse measurements at 50 Hz (60 Hz), single-sheet test

Grade named according to isovac®	Specific total loss				Magnetic polarization			Relative permeability
	1.0 T P10		1.5 T P15		2500 A/m J25	5000 A/m J50	10000 A/m J100	1.5 T $\mu_r$
	50 Hz [W/kg]	60 Hz [W/lb]	50 Hz [W/kg]	60 Hz [W/lb]	[T]	[T]	[T]	[-]
isovac 470-65 K HE	1.55	0.91	3.90	2.30	1.59	1.67	1.79	1300

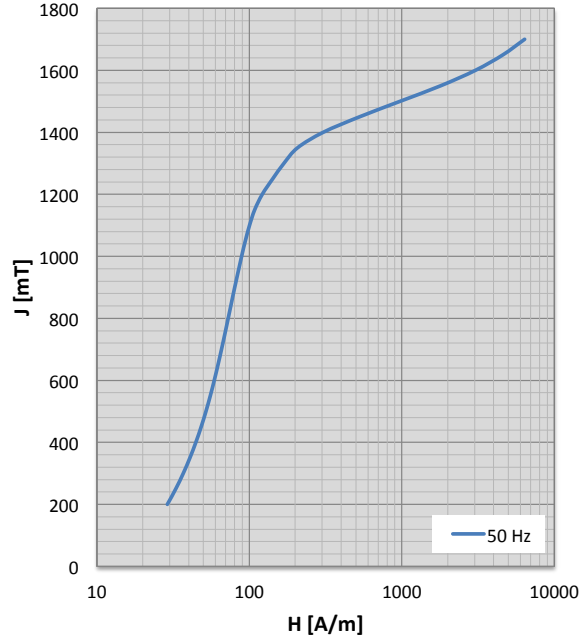
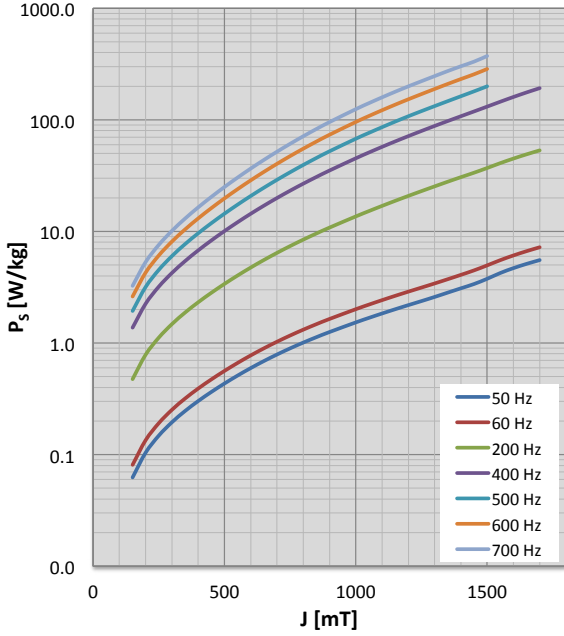
**Physical properties:**

Typical values

Grade named according to isovac®	Density $\rho$ [g/cm <sup>3</sup> ]	Specific electrical resistance $\rho_s$ [ $\mu\Omega\text{cm}$ ]	Thermal conductivity $\lambda$ [W/mK]
isovac 470-65 K HE	7.75	38.5	30

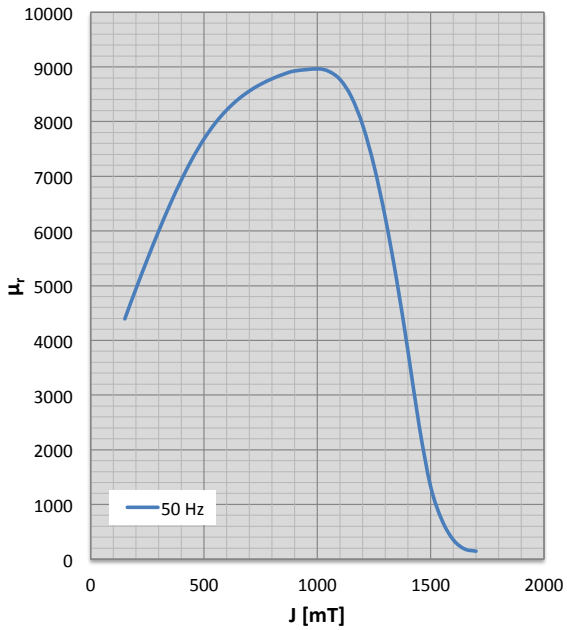
**Characteristics  $P_s/J$  loss curve and characteristics  $J/H$  magnetization curve**

Test direction: Mean value from longitudinal and transverse measurements at indicated frequencies, single-sheet test



**Characteristics  $\mu_r/J$  permeability curve**

Test direction: Mean value from longitudinal and transverse measurements at 50 Hz, single-sheet test



**Frequency dependence of magnetic properties**

Test direction: Mean value longitudinal and transverse at indicated frequencies and polarizations, single-sheet test

50 Hz				60 Hz				200 Hz			
J [mT]	H [A/m]	P <sub>s</sub> [W/kg]	μ <sub>r</sub> [-]	J [mT]	H [A/m]	P <sub>s</sub> [W/kg]	μ <sub>r</sub> [-]	J [mT]	H [A/m]	P <sub>s</sub> [W/kg]	μ <sub>r</sub> [-]
				100	21	0.03	3715				
150	25	0.06	4391	150	26	0.08	4229	150	37	0.47	2985
200	29	0.10	4944	200	30	0.13	4735	200	45	0.79	3234
250	33	0.15	5483	250	35	0.19	5228	250	52	1.12	3473
300	37	0.19	5998	300	39	0.25	5699	300	60	1.48	3696
350	41	0.25	6484	350	43	0.32	6142	350	68	1.87	3898
400	45	0.30	6931	400	47	0.39	6550	400	76	2.32	4074
450	48	0.36	7333	450	51	0.47	6916	450	84	2.82	4218
500	52	0.43	7683	500	55	0.56	7232	500	92	3.39	4326
550	55	0.51	7974	550	59	0.66	7495	550	101	4.03	4394
600	59	0.60	8212	600	63	0.77	7707	600	109	4.74	4426
650	62	0.69	8405	650	66	0.90	7875	650	118	5.54	4428
700	66	0.79	8559	700	70	1.03	8006	700	127	6.42	4408
750	69	0.90	8682	750	74	1.17	8106	750	137	7.39	4371
800	73	1.01	8783	800	78	1.32	8181	800	147	8.44	4323
850	76	1.13	8865	850	82	1.48	8237	850	158	9.58	4269
900	80	1.25	8926	900	87	1.64	8276	900	170	10.82	4211
1000	89	1.53	8963	1000	96	2.01	8314	1000	196	13.63	4073
1050	94	1.68	8919	1050	101	2.21	8311	1050	210	15.22	3993
1100	100	1.84	8770	1100	106	2.42	8266	1100	224	16.93	3912
1150	108	2.01	8453	1150	112	2.65	8130	1150	238	18.80	3835
1200	122	2.19	7933	1200	123	2.89	7793	1200	256	20.81	3739
1250	142	2.38	7189	1250	142	3.14	7156	1250	278	22.98	3620
1300	169	2.59	6236	1300	168	3.42	6245	1300	291	25.33	3560
1350	207	2.83	5097	1350	208	3.73	5116	1350	292	27.89	3564
1400	305	3.09	3794	1400	304	4.08	3812	1400	344	30.64	3248
1450	528	3.38	2414	1450	518	4.48	2431	1450	533	33.57	2328
1500	975	3.76	1321	1500	970	4.96	1328	1500	978	37.00	1319
1550	1796	4.24	707	1550	1815	5.53	694	1550	1824	40.93	690
1600	3042	4.69	350	1600	3074	6.09	329	1600	3084	44.96	329
1650	4607	5.12	184	1650	4647	6.65	164	1650	4655	49.08	165
1700	6386	5.53	145	1700	6427	7.21	133	1700	6435	53.25	134
1750	8273	5.94	169	1750	8313	7.77	169	1750	8318	57.45	169

**Frequency dependence of magnetic properties**

Test direction: Mean value longitudinal and transverse at indicated frequencies and polarizations, single-sheet test

400 Hz				500 Hz				600 Hz			
J [mT]	H [A/m]	P <sub>s</sub> [W/kg]	μ <sub>r</sub> [-]	J [mT]	H [A/m]	P <sub>s</sub> [W/kg]	μ <sub>r</sub> [-]	J [mT]	H [A/m]	P <sub>s</sub> [W/kg]	μ <sub>r</sub> [-]
								100	49	1.01	1613
150	50	1.37	2179	150	57	1.94	1945	150	64	2.61	1724
200	62	2.25	2332	200	69	3.18	2074	200	78	4.28	1831
250	73	3.20	2476	250	82	4.52	2195	250	93	6.09	1931
300	85	4.24	2608	300	96	6.01	2304	300	109	8.11	2021
350	97	5.42	2723	350	110	7.70	2398	350	125	10.42	2097
400	109	6.76	2816	400	124	9.63	2472	400	142	13.08	2155
450	122	8.30	2884	450	140	11.85	2523	450	161	16.17	2192
500	136	10.07	2923	500	156	14.42	2547	500	181	19.76	2205
550	151	12.09	2929	550	174	17.38	2541	550	202	23.92	2192
600	166	14.40	2907	600	193	20.77	2509	600	225	28.70	2156
650	183	17.00	2863	650	213	24.63	2458	650	249	34.15	2103
700	200	19.92	2803	700	235	29.00	2393	700	276	40.34	2039
750	219	23.18	2734	750	258	33.92	2321	750	305	47.33	1969
800	239	26.79	2660	800	283	39.41	2247	800	335	55.15	1898
850	261	30.76	2588	850	310	45.53	2176	850	369	63.87	1832
900	284	35.14	2518	900	339	52.27	2108	900	404	73.51	1770
1000	334	45.23	2381	1000	402	67.70	1979	1000	480	95.67	1657
1050	361	50.99	2314	1050	436	76.42	1917	1050	520	108.25	1606
1100	389	57.26	2248	1100	471	85.95	1859	1100	562	121.92	1557
1150	419	64.07	2185	1150	506	96.40	1807	1150	606	136.77	1511
1200	450	71.45	2122	1200	544	107.67	1754	1200	651	152.81	1466
1250	482	79.46	2057	1250	586	119.70	1700	1250	698	170.09	1423
1300	517	88.12	2001	1300	625	132.72	1656	1300	748	188.99	1384
1350	555	97.51	1956	1350	661	147.01	1626	1350	803	209.76	1348
1400	590	107.71	1888	1400	714	162.68	1560	1400	855	231.98	1302
1450	663	118.88	1724	1450	819	179.96	1411	1450	923	255.94	1224
1500	1000	131.37	1283	1500	1036	199.72	1211	1500	1147	285.47	1065
1550	1816	145.29	701								
1600	3064	160.26	355								
1650	4638	176.01	192								
1700	6428	192.28	149								
1750	8328	208.82	168								

**Frequency dependence of magnetic properties**

Test direction: Mean value longitudinal and transverse at indicated frequencies and polarizations, single-sheet test

— 700 Hz			
J [mT]	H [A/m]	P <sub>s</sub> [W/kg]	μ <sub>r</sub> [-]
150	68	3.25	1606
200	84	5.32	1701
250	101	7.58	1790
300	118	10.12	1869
350	136	13.03	1934
400	155	16.43	1983
450	175	20.39	2013
500	197	25.01	2019
550	221	30.38	2001
600	247	36.59	1962
650	275	43.71	1907
700	305	51.81	1842
750	338	60.97	1772
800	374	71.27	1702
850	412	82.76	1638
900	453	95.48	1578
1000	540	124.64	1474
1050	585	141.12	1428
1100	632	159.05	1385
1150	682	178.55	1343
1200	732	199.52	1305
1250	780	221.94	1271
1300	839	246.47	1233
1350	912	273.54	1188
1400	966	302.00	1154
1450	998	332.29	1129
1500	1189	373.18	1010

## Available Dimensions

Grade named according to isovac®	Delivery form	Width [mm]	Length [mm]
isovac 470-65 K HE	Wide strip / Slit strip	19 – 1600	-
	Cut-to-length sheets	300 – 1600	300 – 5000

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