

## isovac 450-50 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 450-50 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 450-50 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.

**Grade named according to conventional international standards:**

Grade named according to isovac®	DIN EN 10341		DIN EN 10126 DIN EN 10165	IEC/CEI 60404-8-3	ASTM A 683 M	ASTM A 683	AISI	IS15391
	Material No.	Abbreviation						
isovac 450-50 K HE	1.0843	M 450-50 K	M 450-50 E	450-50 K5	47S551M	47S250	M-45	50-SP-450 E5

**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 450-50 K HE	400	450	23	170

**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 1.5 T $\mu_r$ [-]
	1.0 T P10		1.5 T P15		2500 A/m J25	5000 A/m J50	10000 A/m J100	
	50 Hz [W/kg]	60 Hz [W/lb]	50 Hz [W/kg]	60 Hz [W/lb]	[T]	[T]	[T]	
isovac 450-50 K HE	1.55	0.88	3.80	2.17	1.61	1.70	1.82	1750

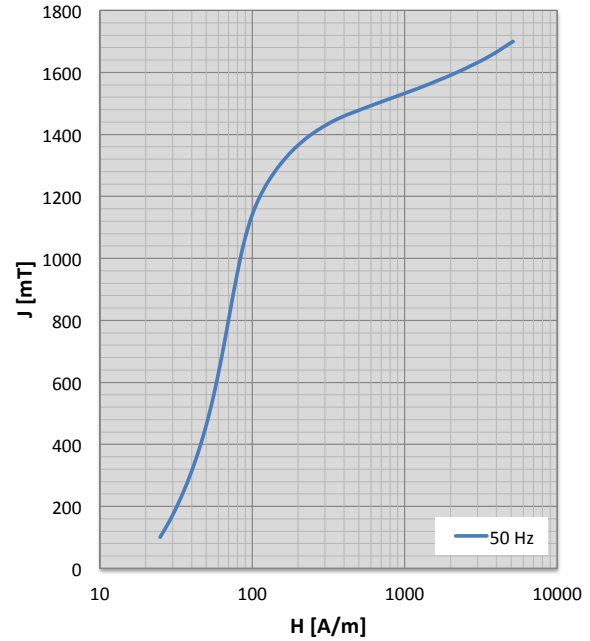
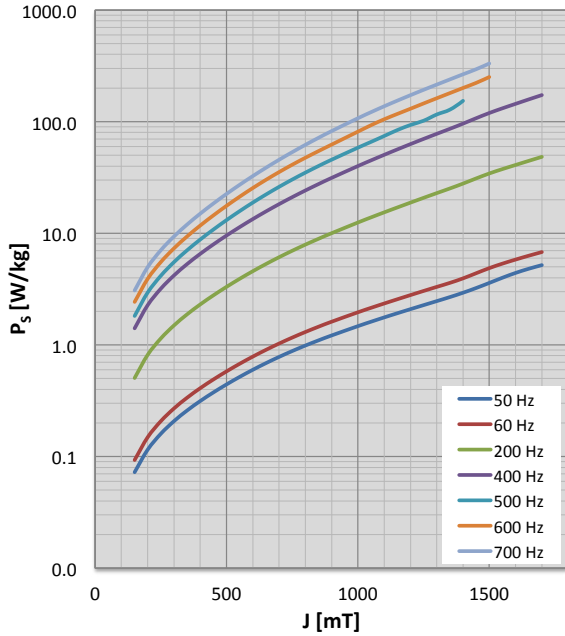
**Physical properties:**

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 450-50 K HE	7.8	28	41

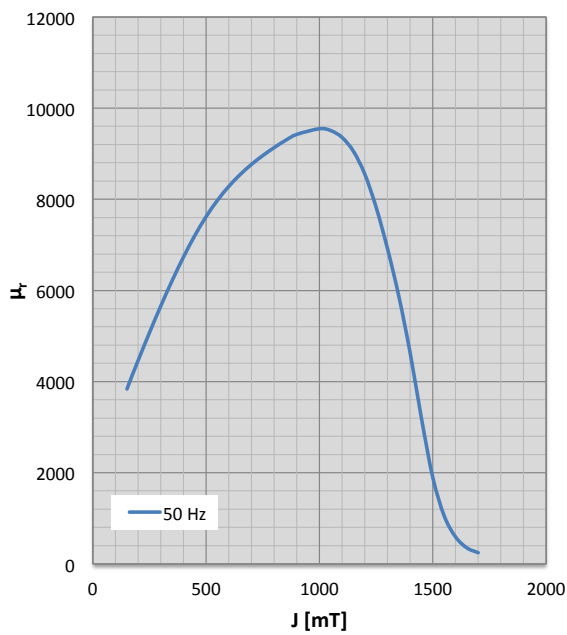
**Characteristics  $P_s/J$  loss curve and characteristics  $J/H$  magnetization curve**

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	25	0.03	3207					100	33	0.20	2390
150	28	0.07	3840	150	30	0.09	3581	150	41	0.50	2688
200	32	0.12	4465	200	35	0.15	4120	200	48	0.82	2980
250	36	0.16	5074	250	39	0.21	4645	250	55	1.14	3263
300	39	0.21	5661	300	43	0.27	5150	300	63	1.49	3530
350	43	0.26	6216	350	47	0.34	5627	350	70	1.88	3777
400	46	0.31	6733	400	51	0.41	6070	400	77	2.30	3998
450	49	0.38	7204	450	55	0.49	6471	450	84	2.78	4188
500	52	0.44	7621	500	58	0.58	6824	500	92	3.31	4343
550	55	0.52	7978	550	62	0.68	7123	550	99	3.91	4459
600	58	0.60	8283	600	65	0.79	7375	600	106	4.57	4539
650	61	0.69	8543	650	69	0.90	7584	650	114	5.30	4588
700	64	0.78	8766	700	72	1.03	7758	700	122	6.10	4612
750	67	0.88	8960	750	76	1.16	7903	750	130	6.97	4616
800	70	0.99	9134	800	79	1.30	8026	800	138	7.91	4605
850	73	1.10	9292	850	83	1.45	8132	850	148	8.92	4584
900	76	1.22	9424	900	87	1.61	8221	900	157	10.01	4552
1000	84	1.47	9548	1000	96	1.96	8340	1000	179	12.49	4456
1050	88	1.61	9507	1050	100	2.15	8364	1050	190	13.88	4393
1100	94	1.76	9354	1100	105	2.35	8357	1100	202	15.39	4328
1150	102	1.92	9050	1150	111	2.56	8290	1150	215	17.03	4264
1200	112	2.09	8548	1200	119	2.79	8046	1200	229	18.82	4171
1250	128	2.27	7820	1250	133	3.04	7523	1250	246	20.77	4044
1300	151	2.47	6914	1300	154	3.31	6760	1300	260	22.90	3987
1350	185	2.68	5868	1350	187	3.59	5802	1350	269	25.20	4029
1400	244	2.93	4623	1400	246	3.94	4603	1400	295	27.86	3783
1450	363	3.23	3184	1450	365	4.39	3177	1450	383	31.00	2938
1500	658	3.59	1889	1500	662	4.87	1879	1500	660	34.33	1887
1550	1248	4.00	1053	1550	1258	5.35	1043	1550	1249	37.58	1089
1600	2199	4.41	592	1600	2212	5.81	589	1600	2210	40.91	590
1650	3532	4.81	351	1650	3542	6.29	352	1650	3552	44.52	327
1700	5138	5.18	244	1700	5142	6.79	245	1700	5168	48.36	225

**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	43	0.57	1862	100	43	0.73	1836	100	47	0.99	1679
150	53	1.41	2064	150	54	1.82	2013	150	59	2.42	1832
200	63	2.27	2261	200	65	2.95	2185	200	72	3.91	1981
250	73	3.19	2448	250	76	4.16	2347	250	84	5.52	2121
300	84	4.19	2623	300	88	5.51	2495	300	97	7.33	2248
350	95	5.30	2779	350	100	7.04	2624	350	111	9.37	2358
400	106	6.54	2912	400	112	8.79	2729	400	125	11.73	2447
450	117	7.95	3019	450	126	10.80	2805	450	140	14.46	2509
500	129	9.54	3093	500	140	13.12	2847	500	157	17.62	2541
550	141	11.36	3134	550	155	15.79	2853	550	174	21.27	2540
600	154	13.40	3143	600	171	18.83	2828	600	193	25.42	2512
650	167	15.69	3128	650	188	22.24	2781	650	213	30.11	2463
700	181	18.24	3094	700	207	26.06	2718	700	235	35.33	2399
750	197	21.06	3047	750	226	30.28	2647	750	258	41.12	2329
800	213	24.17	2992	800	247	34.94	2577	800	282	47.48	2258
850	230	27.59	2934	850	269	40.03	2511	850	308	54.47	2191
900	249	31.35	2874	900	292	45.62	2450	900	336	62.29	2127
1000	290	40.01	2743	1000	342	58.46	2327	1000	400	81.38	1992
1050	312	44.99	2673	1050	369	65.87	2260	1050	436	92.92	1917
1100	337	50.44	2600	1100	401	74.38	2185	1100	473	105.01	1849
1150	363	56.40	2527	1150	436	84.07	2107	1150	509	117.25	1797
1200	389	62.92	2453	1200	466	93.36	2050	1200	546	130.52	1748
1250	414	70.04	2380	1250	489	101.91	2020	1250	588	145.57	1693
1300	449	77.78	2304	1300	539	115.90	1920	1300	632	162.05	1638
1350	496	86.25	2225	1350	498	128.03	1970	1350	682	180.17	1578
1400	518	96.00	2148	1400	813	153.64	1461	1400	729	200.28	1528
1450	518	107.37	2045	1450	1499	197.17	332	1450	762	222.46	1504
1500	697	119.52	1754					1500	852	251.02	1402
1550	1259	131.69	1175								
1600	2232	144.38	583								
1650	3581	158.22	261								
1700	5194	172.97	173								



## Available Dimensions

Grade named according to isovac®	Delivery form	Width [mm]	Length [mm]
isovac 450-50 K HE	Wide strip / Slit strip	19 – 1560	-
	Cut-to-length sheets	300 – 1560	300 – 5000

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