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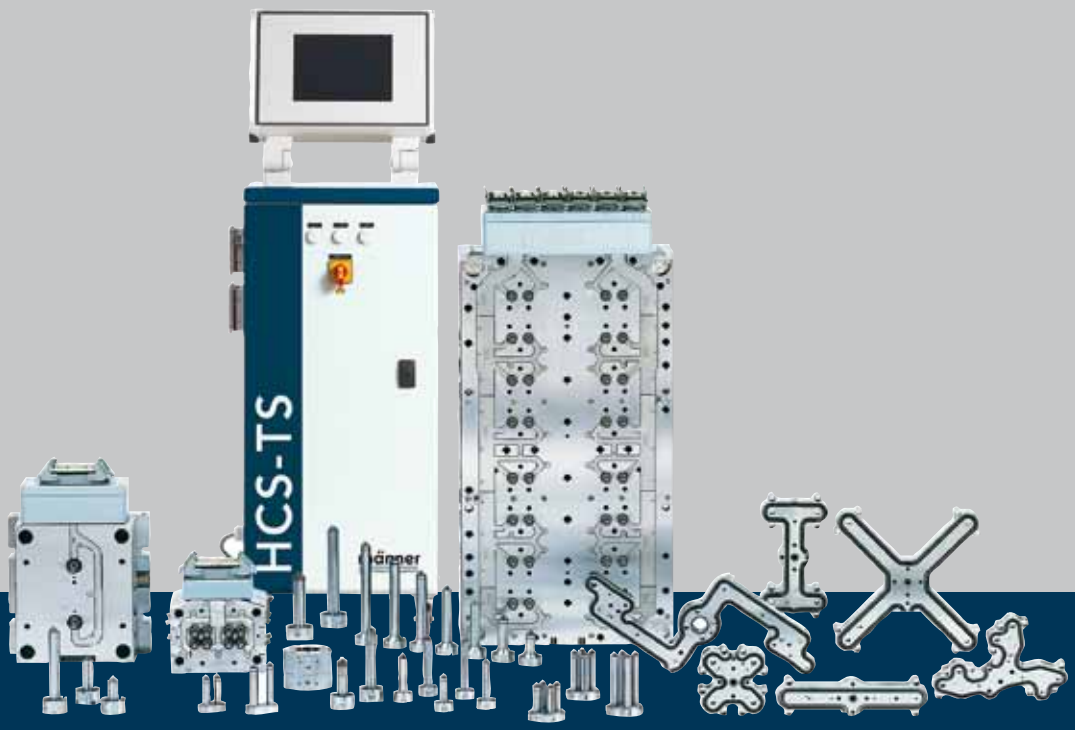

TECHNICAL INFORMATION
HOT RUNNER SYSTEMS

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Start-up Instructions

for männer Hot Runner Valve Gate Systems

Please note: use dehumidified air only. Minimum air pressure required for pin actuation: 6 bar.

MES

1	2	3	4
Turn on mold cooling and gate cooling before heating up the hot runner system.	During the heating cycle, the compressed air for pin operation must be switched off.	In general, use the "soft-start" function of the control system. Heat the main manifold with the sprue bushing to approx. 80-90% of the required production temperature.	Turn on the submanifolds (cylinder blocks) and nozzles. Heat up the entire system to production temperature.
5	**6**	**7**	**IMPORTANT!**
Maintain the system at production temperature for approx. 5 -10 min. prior to operating valve pins.	Turn on the compressed air for pin operation (min. 6 bar).	Start production.	When starting up after a production stop, purge the barrel of all remaining resin before restarting. For start-up, reduce the injection volume to 70% of the required amount.

MSS / MMS / MHS / MIS / MXS / MZS

1	2	3
Turn on mold cooling and gate cooling before heating up the hot runner system.	In general, use the "soft-start" function of the hot runner control system. Heat up manifold to approx. 80-90% of the required production temperature.	Turn on the nozzles, and heat up the entire system to production temperature.
4	**5**	**IMPORTANT!**
Maintain the system at production temperature for approx. 5-10 minutes prior to operating valve pins.	After the system is fully heated, start production.	When starting up after a production stop, purge the barrel of all remaining resin before restarting. For start-up, reduce the injection volume to 70% of the required amount.

FILLING

Several injection cycles may be required to fill the hot runner system the first time the unit is used. Continually check the cavities after each cycle and remove all short shots until ultimately all parts are completely filled.

EMPTYING THE INJECTION UNIT

To prevent the gate orifices and valve pins from being damaged by cold material, do not actuate the valve pins while setting up the injection molding machine or while emptying the injection unit of any remaining material.

PRODUCTION STOP

Reduce the temperature of the hot runner heating system to standby temperature (100° C to 150° C, depending on the resin). The valve pins should be in closed position.

SYSTEM SHUTDOWN

When shutting down the hot runner system, switch off all control circuits at the same time. To prevent the hot runner system from being damaged by heat accumulation, allow the mold cooling system to run for another 20-30 minutes at approx. 30° C.

REMOVING THE MOLD INSERTS

Before removing the mold inserts, make sure that the hot runner is switched off (temperature not exceeding 60° C) and the valve pins are in open position.

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Maintenance Tips

for männer Hot Runner Valve Gate Systems

Polyolefins (f.e. PP/PE)	Polyesters (f.e. PC/PBT/PET)	Engineered resins (f.e. PA)
Approx. 2 million cycles*	Approx. 1 million cycles*	Approx. 0.5 million cycles*

Insulating ring

Check for leaks.

If any leaks are detected, please contact the männer service team.

Melt flow from manifold to hot runner nozzle

Check for leaks.

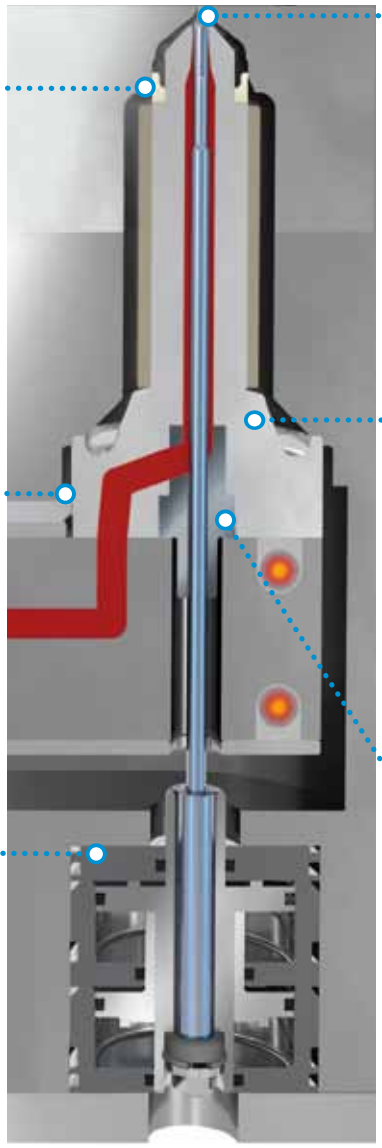
Always replace seals whenever the components are disassembled.

Pneumatic unit

Only use dehumidified air to operate the pneumatic unit of männer hot runner systems.

Remove heavy dirt buildup using cleaning fluid, and apply pneumatic grease to the contact surfaces.

Replace any brittle seals.



Gate

If the surface quality is not satisfactory, ensure that the valve pin and gate orifice are not damaged.

If any damage is detected, please contact the männer service team.

Nozzles

Clean off any dirt or deposits.

NOTE: Do not clean heating elements in high-temperature sand baths or pyrolysis furnaces.

Valve pin guide bushing and valve pin

Use an ultrasonic cleaning system or similar equipment to clean off any dirt or deposits produced as a result of outgassing.

NOTE: Do not use any abrasives to clean the valve pin guide bushing or valve pin.

If any damage is detected, please contact the männer service team.

* The maintenance intervals specified here are only an approximation. Actual intervals may vary, depending on the resins used, the injection parameters, and the part geometry. We will be happy to provide you with maintenance information for your specific hot runner system and application upon request.

We recommend that you check your männer hot runner system regularly to ensure optimum performance and long life.

Please contact the männer service team if any damage to the parts is detected.

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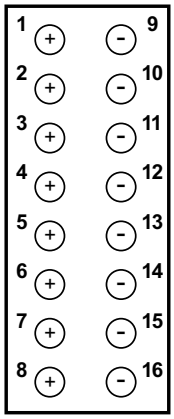
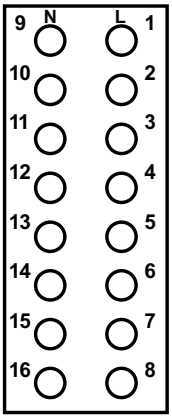
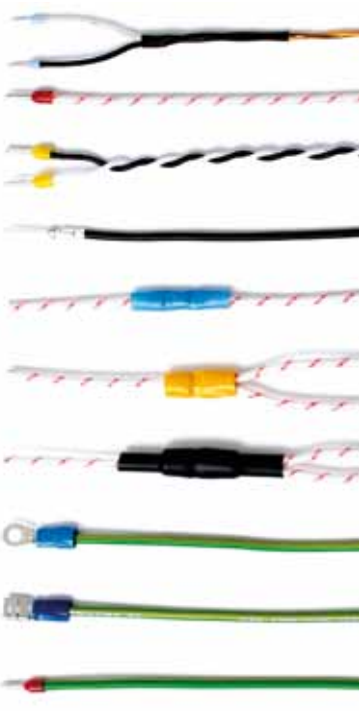
Plug Arrangement on Mold Side

(EUROMAP 14
Technical Recommendation)

Female connector	Male connector
	
Thermocouple	**Power**

Connections

in accordance with VDE guidelines



1 Thermocouple connection
2 1.5² wire with ferrule for blocks
3 Heater band connection with ferrule
4 Crimp contact (pin), 1.5² connection
5 Extension, 1.5² wire
6 Parallel connection (2 tubular heating elements)
7 Parallel connection with heat-shrink tubing
8 Ring plug connection
9 Flat plug connection
10 Ferrule connection

Grounding conductors on mold

Power – Resistance – Current

Table

The resistance value can vary slightly (±10%) depending on the temperature and/or cable length.

This deviation in value, however, does not affect the heating behavior.

Power [W] $P = U^2 / R$	Resistance [Ω] $R = U / I$	Current [A] $I = U / R$
200	264,5	0,8
250	211,5	1,0
300	176,3	1,3
350	151,1	1,5
400	132,2	1,7
450	117,5	1,9
500	105,8	2,1
600	88,1	2,6
700	75,5	3,0
800	66,1	3,4
900	58,7	3,9
1000	52,9	4,3
1500	35,2	6,5
2000	26,4	8,6
2500	21,1	10,8
3000	17,6	13,0
3500	15,1	15,2

Thermocouples
Extension / Compensating Cables

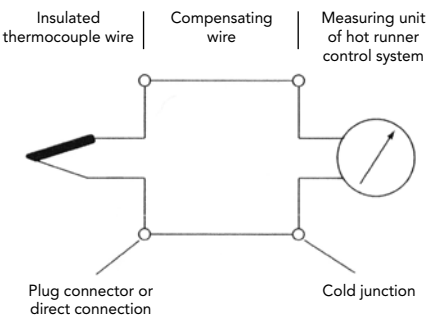
Overview

Thermocouple Type	Material	IEC 60584 / DIN IEC 584	DIN 43710	ANSI MC 96.1	NF-C 42-324	BC 4937
R S	⊕ Platinum/13% Rhodium ⊖ Platinum ⊕ Platinum/10% Rhodium ⊖ Platinum	RCA/SCA RCB/SCB	SoPtRh/ SoPt	SX	SC	RX/SX
B	⊕ Platinum/20% Rhodium ⊖ Platinum/6% Rhodium	BC		BX	BC	Color coding not specified BX
J	⊕ Iron ⊖ Copper-nickel	JX	See LX	JX	JX/JC	JX
T	⊕ Copper ⊖ Copper-nickel	TX	See UX	TX	TX/TC	TX
E	⊕ Nickel-chromium ⊖ Copper-nickel	EX		EX	EX/EC	EX
K	⊕ Nickel-chromium ⊖ Nickel	KX KCB KCA	NiCr Ni Fe CuNi	KX VX	KX/KC VC WC	KX VX
N	⊕ Nickel-chromium-silicon ⊖ Nickel-silicon	NX/NC				Color coding not specified NX
U	⊕ Copper ⊖ Copper-nickel		UX			
L	⊕ Iron ⊖ Copper-nickel		LX			

* Type J is used for männer thermocouples.

COMPENSATING CABLES

To ensure proper temperature measurement, please note the following.
When connecting the hot (measuring) junction to the cold (reference) junction in the control unit, make sure you use a compensating cable whose wires are made of original thermocouple material.
Explanation: Wires made of original thermocouple material exhibit the same thermoelectric behavior as the thermocouple pair at the hot junction. As a result, the thermocouple voltage remains constant all the way to the cold junction in the control unit.
This cold junction compensation is necessary, since thermocouples measure the temperature difference between the hot junction and the cold junction (see diagram on right). This helps to prevent parasitic thermocouple voltages.



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Voltage Values in µV

for Type J Thermocouple (iron/copper-nickel)

°C	0	+1	+2	+3	+4	+5	+6	+7	+8	+9
0	0	50	101	151	202	253	303	354	405	456
10	507	558	609	660	711	762	814	865	916	968
20	1019	1071	1122	1174	1226	1277	1329	1381	1433	1485
30	1537	1589	1641	1693	1745	1797	1849	1902	1954	2006
40	2059	2111	2164	2216	2269	2322	2374	2427	2480	2532
50	2585	2638	2691	2744	2797	2850	2903	2956	3009	3062
60	3116	3169	3222	3275	3329	3382	3436	3489	3543	3596
70	3650	3703	3757	3810	3864	3918	3971	4025	4079	4133
80	4187	4240	4294	4348	4402	4456	4510	4564	4618	4672
90	4726	4781	4835	4889	4943	4997	5052	5106	5160	5215
100	5269	5323	5378	5432	5487	5541	5595	5650	5705	5759
110	5814	5868	5923	5977	6032	6087	6141	6196	6251	6306
120	6360	6415	6470	6525	6579	6634	6689	6744	6799	6854
130	6909	6964	7019	7074	7129	7184	7239	7294	7349	7404
140	7459	7514	7569	7624	7679	7734	7789	7844	7900	7955
150	8010	8065	8120	8175	8231	8286	8341	8396	8452	8507
160	8562	8618	8673	8728	8783	8839	8894	8949	9005	9060
170	9115	9171	9226	9282	9337	9392	9448	9503	9559	9614
180	9669	9725	9780	9836	9891	9947	10002	10057	10113	10168
190	10224	10279	10335	10390	10446	10501	10557	10612	10668	10723
200	10779	10834	10890	10945	11001	11056	11112	11167	11223	11278
210	11334	11389	11445	11501	11556	11612	11667	11723	11778	11834
220	11889	11945	12000	12056	12111	12167	12222	12278	12334	12389
230	12445	12500	12556	12611	12667	12722	12778	12833	12889	12944
240	13000	13056	13111	13167	13222	13278	13333	13389	13444	13500
250	13555	13611	13666	13722	13777	13833	13888	13944	13999	14055
260	14110	14166	14221	14277	14332	14388	14443	14499	14554	14609
270	14665	14720	14776	14831	14887	14942	14998	15053	15109	15164
280	15219	15275	15330	15386	15441	15496	15552	15607	15663	15718
290	15773	15829	15884	15940	15995	16050	16106	16161	16216	16272
300	16327	16383	16438	16493	16549	16604	16659	16715	16770	16825
310	16881	16936	16991	17046	17102	17157	17212	17268	17323	17378
320	17434	17489	17544	17599	17655	17710	17765	17820	17876	17931
330	17986	18041	18097	18152	18207	18262	18318	18373	18428	18483
340	18538	18594	18649	18704	18759	18814	18870	18925	18980	19035
350	19090	19146	19201	19256	19311	19366	19422	19477	19532	19587
360	19642	19697	19753	19808	19863	19918	19973	20028	20083	20139
370	20194	20249	20304	20359	20414	20469	20525	20580	20635	20690
380	20745	20800	20855	20911	20966	21021	21076	21131	21186	21241
390	21297	21352	21407	21462	21517	21572	21627	21683	21738	21793
400	21848	21903	21958	22014	22069	22124	22179	22234	22289	22345
410	22400	22455	22510	22565	22620	22676	22731	22786	22841	22896
420	22952	23007	23062	23117	23172	23228	23283	23338	23393	23449
430	23504	23559	23614	23670	23725	23780	23835	23891	23946	24001
440	24057	24112	24167	24223	24278	24333	24389	24444	24499	24555
450	24610	24665	24721	24776	24832	24887	24943	24998	25053	25109
460	25164	25220	25275	25331	25386	25442	25497	25553	25608	25664

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Control Parameters

männer HCS Hot Runner Temperature Control Systems

männer HCS hot runner temperature control systems (for example, HCS-TS, HCS 2) use a two-position PID controller. Its monitoring characteristics are comprised of proportional, differential and integral control actions.		IMPORTANT: Control parameters should only be changed if a desired improvement in quality cannot be achieved with self-optimization.
Proportional band Xp (Pb1)	The proportional control action delivers a control output, which is an undelayed signal that is proportional to the error. A small error results in a low control output, which, however, is not sufficient to correct the error.	The sensitivity of the controller and, thus, the adjustment to the process are defined by the gain factor. The inverse value of the gain is called the proportional band (Xp). The proportional band can be set to a value from 0.0% to 999.0%.
	Large proportional action ·····	**Fast response by the controller; possible oscillations**
Derivative (rate) Tv1	The derivative control action calculates the rate of change of the error and delivers a control output. This signal is proportional to the rate of change of the error. If the process output moves away from the setpoint, the control output increases more rapidly	compared to that of a proportional controller. This is called predictive control. The characteristic parameter is the derivative (rate) Tv, which can be set to a value from 0.0 to 999.0 seconds.
	Large derivative action ·····	**Fast response to temperature changes**
	Small derivative action ·····	**Slow response to temperature changes; may result in overshoot during start-up**
Integral (reset) Tn1	The integral control action calculates the sum of all past errors and delivers a control output. The integral controller adds together small deviations between the setpoint and actual process output and increases or decreases the control output until the deviation is	zero. The control output is maintained until a new error arises. The characteristic parameter is the reset time Tv, which can be set to a value from 0.0 to 999.0 seconds.
	Large integral action ·····	**Slow, damped response**
	Small integral action ·····	**Faster response; may result in oscillations**
Cycle time T1	The cycle time is the time required to complete the heating and pause actions for a specific power setting. The cycle time can be set to a value from 0.0 to 999.0 seconds.	Example: if the cycle time is 60 seconds and the power setting is 50%, the heating elements are on for 30 seconds and then off for 30 seconds.
Duty cycle	A duty cycle of 100% means that full power is delivered to the heating circuit; a duty cycle of 50% means that	only half of the power is delivered. The duty cycle can be set to a value between 0% and 100%.

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