SHELL HEAT TRANSFER FLUID S5 T

- ULTRA-HIGH WORKING TEMPERATURES
- EXTENDED MAINTENANCE INTERVALS

SHELL LUBRICANT SOLUTIONS

SHELL HEAT TRANSFER FLUID S5 T DELIVERS CONSISTENT PERFORMANCE AT ULTRA-HIGH WORKING TEMPERATURES FOR LONG PERIODS OF CONTINUOUS OPERATION.

Enclosed, circulating heat transfer systems are vital in applications such as concentrated solar power systems, plastic and medium-density fibreboard moulding, food and beverage preparation and fermentation, and oil and gas refining. Some applications expose heat transfer fluids to severe working conditions that demand reliable fluid performance.

SHELL'S HIGHEST WORKING TEMPERATURE HEAT TRANSFER FLUID

Shell Heat Transfer Fluid S5 T has been designed to meet challenging demands. It delivers consistent performance at ultra-high working temperatures for long periods of continuous operation, offers long maintenance intervals and avoids unplanned downtime.

Shell Heat Transfer Fluid S5 T uses biphenyl–diphenyl oxide synthetic fluid and has a dual-phase heat conduction capability. Being able to work in both liquid and vapour phases maximises the fluid's heat conduction capacity across a wide range of temperatures. In addition, its low liquid viscosity enables good heat transfer and prevents the formation of deposits. Shell Heat Transfer Fluid S5 T is designed to work across a wide range of temperatures with a maximum bulk temperature of 400°C and film temperature of 430°C to provide high heat transfer efficiency for the most extreme applications.

In addition, Shell Heat Transfer Fluid S5 T is non-corrosive to the materials commonly used to construct heat transfer systems. This minimises the risk of leaks, reduces fluid consumption and extends system maintenance intervals.

Lower oil consumption, longer system maintenance intervals, stable performance and less corrosion all contribute to reducing the total cost of ownership for heat transfer systems.

SPECIFICATIONS

Meets GB 23971-2009 L-QD400 specification

Typically meets DIN 51522 requirements

WHY USE SHELL HEAT TRANSFER FLUID S5 T FOR CONCENTRATED SOLAR POWER SYSTEMS?

PROPERTY	SHELL HEAT TRANSFER FLUID S5 T	CONVENTIONAL PRODUCT
Working temperature (bulk), °C	≤400	≤320
Heat stability	Very stable	Easily oxidised
Heat transfer efficiency	Good and long lasting	Falls with use
Sludge	Minimal	Typical
Operating life, y	≥10	c. 3
Top-up rate, %/y	<3%,* sealed for life in some cases	10–15

*Should not be deemed as product specification or guarantee. Source: Kline report, 2019.

SHELL HEAT TRANSFER FLUID S5 T PROPERTIES**

PROPERTY	METHOD	TYPICAL VALUE
Density at 20°C, kg/m³	ISO 12185	1,063
Maximum bulk temperature, °C	-	400
Maximum film temperature, °C	-	430
Flash point (COC), °C	ASTM D92	128
Flash point (PMCC), °C	ASTM D93	118
Crystallisation point, °C	-	12
Kinematic viscosity at 40°C, mm²/s	ISO 3104	2.5
Kinematic viscosity at 100°C, mm²/s	ISO 3104	1.0
Autoignition temperature, °C	DIN 51794	600
Total acid number, mg KOH/g	ASTM D974	≤0.01
Conradson carbon residue, %	ISO 10370	≤0.01
Copper corrosion (3 h at 100°C)	ISO 2160	≤1
Coefficient of thermal expansion at 200°C, °C⁻¹	-	0.000979
Normal boiling point, °C	-	257
Best working temperature: liquid phase, °C	-	12-400
Best working temperature: vapour phase, °C	-	257-400
Critical density, g/ml	-	0.357
Critical pressure, bar	-	33
Critical temperature, °C	-	499
Average molecular weight	-	166
Heat of melting, kJ/kg		97.3
Heat of evaporation, kJ/kg		206
Electrical resistivity at 20°C, Ω·m		6.4 × 109
Surface tension in air at 25°C, mN/m		36.6
Volume expansion rate (melting), %		6.69
Volume expansion rate (solidifying), %		-6.27
Sulphur content, ppm		<5
Chloride content, ppm		<5

**These data are based on samples tested in a laboratory and are not guaranteed for all samples.

SHELL HEAT TRANSFER FLUID S5 T VAPOUR PHASE PROPERTIES**

TEMPERATURE		DENSITY		SPECIFIC HEAT		THERMAL CONDUCTIVITY		ENTHALPY		VISCOSITY		LATENT HEAT	
°C	°F	kg/m³	lb/ft³	kJ/kg·k	Btu/lb·°F	W/m·k	Btu/ft h·°F	kJ/kg	Btu/lb	mm²/s	mPa·s	kJ/kg	Btu/lb
12	54	-	-	0.99	0.236	0.0080	0.0046	418.3	179.8		0.0056	418.3	179.8
20	68	-	-	1.02	0.242	0.0084	0.0049	426.7	183.5		0.0058	414.2	178.1
30	86	-	-	1.05	0.250	0.0089	0.0052	437.3	188.0		0.0060	409.0	175.8
40	104	-	-	1.08	0.258	0.0095	0.0055	447.8	192.6		0.0062	403.9	173.6
50	122	0.001	0.00008	1.11	0.265	0.0100	0.0058	458.4	197.1		0.0064	398.7	171.4
60	140	0.002	0.00015	1.14	0.273	0.0105	0.0061	470.4	202.2	2723	0.0066	393.5	169.2
70	158	0.005	0.00030	1.17	0.280	0.0111	0.0064	482.4	207.4	1430	0.0068	388.4	167.0
80	176	0.009	0.00056	1.20	0.288	0.0116	0.0067	494.5	212.6	840	0.0070	383.2	164.7
90	194	0.016	0.00099	1.24	0.295	0.0121	0.0070	506.5	217.7	492	0.0072	378.1	162.5
100	212	0.027	0.00167	1.27	0.303	0.0126	0.0073	518.5	222.9	299	0.0075	372.5	160.1
110	230	0.042	0.00260	1.30	0.310	0.0132	0.0076	531.8	228.6	179	0.0077	367.5	158.0
120	248	0.066	0.00409	1.33	0.318	0.0138	0.0080	545.1	234.3	126	0.0079	362.6	155.9
130	266	0.102	0.00634	1.36	0.325	0.0143	0.0083	558.3	240.0	84.1	0.0081	357.6	153.7
140	284	0.154	0.00961	1.39	0.333	0.0149	0.0086	571.6	245.7	57.4	0.0083	352.7	151.6
150	302	0.215	0.0134	1.42	0.339	0.0155	0.0090	584.9	251.4	40.2	0.0085	347.7	149.5
160	320	0.303	0.0189	1.45	0.346	0.0161	0.0093	599.9	257.9	28.7	0.0087	342.7	147.3
170	338	0.426	0.0266	1.48	0.353	0.0167	0.0096	615.0	264.4	21.2	0.0089	337.8	145.2
180	356	0.582	0.0363	1.51	0.360	0.0172	0.0100	630.0	270.8	16.0	0.0091	332.8	143.1
190	374	0.784	0.0489	1.53	0.366	0.0178	0.0103	645.1	277.3	12.2	0.0093	327.9	140.9
200	392	1.04	0.0649	1.56	0.373	0.0183	0.0106	660.1	283.8	9.40	0.0096	322.8	138.8
210	410	1.36	0.0849	1.59	0.380	0.0190	0.0110	676.1	290.6	7.53	0.0098	317.8	136.6
220	428	1.70	0.106	1.62	0.386	0.0196	0.0113	692.1	297.5	5.95	0.0100	312.9	134.5
230	446	2.16	0.135	1.65	0.393	0.0201	0.0116	708.0	304.4	4.76	0.0102	307.9	132.4
240	464	2.72	0.170	1.67	0.400	0.0207	0.0120	724.0	311.3	3.84	0.0104	303.0	130.2
250	482	3.39	0.212	1.71	0.408	0.0214	0.0124	740.0	318.1	3.14	0.0106	298.0	128.1
260	500	4.17	0.260	1.74	0.415	0.0220	0.0127	757.3	325.6	2.59	0.0108	293.3	126.1
270	518	5.11	0.319	1.77	0.422	0.0226	0.0131	774.6	333.0	2.16	0.0110	288.5	124.0
280	536	6.21	0.388	1.79	0.428	0.0232	0.0134	791.9	340.4	1.81	0.0112	283.8	122.0
290	554	7.48	0.467	1.82	0.435	0.0238	0.0138	809.2	347.9	1.54	0.0114	279.0	120.0
300	572	8.95	0.559	1.85	0.442	0.0244	0.0141	826.5	355.3	1.31	0.0115	274.3	117.9
310	590	10.6	0.663	1.88	0.448	0.0251	0.0145	844.2	362.9	1.14	0.0117	267.7	115.1
320	608	12.3	0.770	1.91	0.455	0.0258	0.0149	861.8	370.5	0.98	0.0119	261.1	112.2
330	626	14.5	0.906	1.93	0.462	0.0264	0.0153	879.5	378.1	0.85	0.0122	254.5	109.4

**These data are based on samples tested in a laboratory and are not guaranteed for all samples.

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SHELL HEAT TRANSFER FLUID S5 T VAPOUR PHASE PROPERTIES** CONTINUED

TEMPERATURE		DENSITY		SPECIFIC HEAT		THERMAL CONDUCTIVITY		ENTHALPY		VISCOSITY		LATENT HEAT	
°C	°F	kg/m³	lb/ft³	kJ/kg·k	Btu/lb·°F	W/m·k	Btu/ft h·°F	kJ/kg	Btu/lb	mm²/s	mPa·s	kJ/kg	Btu/lb
340	644	17.0	1.059	1.96	0.469	0.0271	0.0157	897.1	385.7	0.73	0.0124	247.9	106.6
350	662	20.2	1.261	1.98	0.473	0.0278	0.0161	914.8	393.3	0.64	0.0126	241.3	103.7
360	680	23.1	1.442	2.01	0.479	0.0285	0.0165	933.0	401.1	0.56	0.0128	234.1	100.6
370	698	26.5	1.654	2.03	0.485	0.0292	0.0169	951.2	408.9	0.48	0.0130	226.9	97.56
380	716	30.6	1.910	2.06	0.491	0.0298	0.0172	969.5	416.8	0.43	0.0133	219.8	94.47
390	734	35.2	2.198	2.08	0.498	0.0305	0.0176	987.7	424.6	0.38	0.0135	212.6	91.39
400	752	40.1	2.503	2.11	0.504	0.0311	0.0180	1005.9	432.4	0.34	0.0136	205.4	88.30
410	770	46.1	2.878	2.14	0.510	0.0319	0.0184	1023.6	440.0	0.30	0.0139	196.9	84.63
420	788	52.2	3.259	2.17	0.518	0.0325	0.0188	1041.3	447.7	0.27	0.0141	188.3	80.95
430	806	59.5	3.715	2.21	0.528	0.0332	0.0192	1059.0	455.3	0.25	0.0144	179.8	77.27

SHELL HEAT TRANSFER FLUID S5 T LIQUID PHASE PROPERTIES

TEMPERATURE		DENSITY		SPECIFIC HEAT		THERMAL CONDUCTIVITY		ENTHALPY		VISCOSITY		VAPOUR PRESSURE	
°C	°F	kg/m³	lb/ft³	kJ/kg·k	Btu/lb·°F	W/m k	Btu/ft·h °F	kJ/kg	Btu/lb	mm²/s	mPa·s	kPa	psia
12	54	1,073	66.9	1.51	0.361	0.1372	0.0793	–	–	5.09	5.46	–	–
20	68	1,066	66.5	1.54	0.367	0.1364	0.0788	11.5	4.9	4.45	4.75	–	–
30	86	1,057	66.0	1.57	0.374	0.1353	0.0782	27.4	11.8	3.65	3.86	–	–
40	104	1,048	65.4	1.60	0.382	0.1342	0.0776	43.5	18.7	2.86	2.99	–	–
50	122	1,039	64.9	1.63	0.389	0.1332	0.0770	59.7	25.7	2.06	2.14	0.02	0.003
60	140	1,031	64.3	1.66	0.397	0.1321	0.0764	76.3	32.8	1.85	1.90	0.04	0.006
70	158	1,022	63.8	1.69	0.404	0.1311	0.0758	92.8	39.9	1.64	1.67	0.09	0.013
80	176	1,014	63.3	1.72	0.412	0.1300	0.0751	109.4	47.0	1.42	1.44	0.17	0.025
90	194	1,005	62.8	1.76	0.419	0.1290	0.0745	125.9	54.1	1.21	1.22	0.33	0.048
100	212	997	62.2	1.78	0.425	0.1278	0.0739	142.5	61.3	1.00	1.00	0.50	0.073
110	230	989	61.7	1.81	0.432	0.1265	0.0731	161.3	69.4	0.92	0.91	0.82	0.12
120	248	981	61.2	1.84	0.439	0.1251	0.0723	180.1	77.4	0.84	0.83	1.30	0.19
130	266	972	60.7	1.87	0.447	0.1238	0.0715	199.0	85.5	0.77	0.74	2.01	0.29
140	284	964	60.2	1.90	0.454	0.1224	0.0708	217.8	93.6	0.69	0.66	3.06	0.44
150	302	956	59.7	1.93	0.461	0.1211	0.0700	236.6	101.7	0.61	0.59	4.53	0.66
160	320	947	59.1	1.95	0.466	0.1200	0.0693	256.1	110.1	0.58	0.55	6.56	0.95
170	338	938	58.6	1.97	0.471	0.1189	0.0687	275.6	118.5	0.54	0.51	9.56	1.39
180	356	929	58.0	2.00	0.477	0.1178	0.0681	295.2	126.9	0.51	0.47	13.1	1.90
190	374	920	57.4	2.02	0.482	0.1167	0.0674	314.7	135.3	0.47	0.44	18.0	2.61

SHELL HEAT TRANSFER FLUID S5 T LIQUID PHASE PROPERTIES

TEMPERATURE		DENSITY		SPECIFIC HEAT		THERMAL CONDUCTIVITY		ENTHALPY		VISCOSITY		VAPOUR PRESSURE	
°C	°F	kg/m³	lb/ft³	kJ/kg·k	Btu/lb·°F	W/m·k	Btu/ft·h °F	kJ/kg	Btu/lb	mm²/s	mPa·s	kPa	psia
200	392	911	56.9	2.04	0.487	0.1156	0.0668	334.2	143.7	0.44	0.40	24.4	3.54
210	410	902	56.3	2.07	0.494	0.1136	0.0656	355.6	152.9	0.42	0.38	32.5	4.71
220	428	893	55.7	2.10	0.501	0.1116	0.0645	377.0	162.1	0.40	0.35	41.4	6.00
230	446	884	55.2	2.13	0.509	0.1095	0.0633	398.3	171.2	0.37	0.33	53.6	7.77
240	464	875	54.6	2.16	0.516	0.1075	0.0621	419.7	180.4	0.35	0.31	68.4	9.9
250	482	866	54.1	2.19	0.523	0.1055	0.0610	441.1	189.6	0.33	0.29	86.3	12.5
257	495	860	53.7	2.21	0.528	0.1042	0.0602	457.6	196.7	0.326	0.28	101	14.7
260	500	857	53.5	2.22	0.529	0.1037	0.0599	464.2	199.5	0.32	0.27	108	15.7
270	518	847	52.9	2.24	0.535	0.1018	0.0588	487.2	209.5	0.31	0.26	133	19.3
280	536	838	52.3	2.27	0.542	0.1000	0.0578	510.3	219.4	0.29	0.25	165	23.9
290	554	828	51.7	2.29	0.548	0.0981	0.0567	533.3	229.3	0.28	0.23	200	29.0
300	572	819	51.1	2.32	0.554	0.0963	0.0557	556.4	239.2	0.27	0.22	242	35.1
310	590	807	50.4	2.35	0.561	0.0943	0.0545	579.8	249.2	0.26	0.21	289	41.9
320	608	795	49.7	2.38	0.568	0.0923	0.0534	603.1	259.3	0.25	0.20	339	49.2
330	626	784	48.9	2.41	0.576	0.0904	0.0522	626.5	269.3	0.25	0.19	400	58.0
340	644	772	48.2	2.44	0.583	0.0884	0.0511	649.8	279.4	0.24	0.18	469	68.0
350	662	760	47.4	2.47	0.590	0.0864	0.0499	673.2	289.4	0.23	0.18	547	79.3
360	680	747	46.6	2.50	0.597	0.0842	0.0487	698.9	300.5	0.22	0.17	635	92.1
370	698	734	45.8	2.53	0.604	0.0821	0.0474	724.7	311.5	0.22	0.16	733	106
380	716	720	45.0	2.56	0.611	0.0799	0.0462	750.4	322.6	0.21	0.15	838	140
390	734	707	44.2	2.59	0.618	0.0788	0.0449	776.2	333.7	0.21	0.15	957	151
400	752	694	43.3	2.63	0.628	0.0756	0.0437	801.9	344.7	0.21	0.14	1086	157
410	770	678	42.3	2.68	0.640	0.0732	0.0423	829.4	356.5	0.21	0.14	1243	180
420	788	662	41.3	2.73	0.652	0.0707	0.0409	856.8	368.3	0.20	0.13	1385	201
430	806	646	40.3	2.78	0.664	0.0683	0.0394	884.3	380.1	0.20	0.13	1535	223

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USING THE RIGHT LUBRICANTS CAN SIGNIFICANTLY IMPROVE YOUR OPERATIONS

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