

# Calcium Chloride Special

## Concentrate

Cooling Brine for Applications Down to  $< -50\text{ }^{\circ}\text{C}$



TYFOROP Chemie GmbH

## Characteristics of Calcium Chloride Special

### 1.34 Concentrate

Appearance	Clear, colourless to light yellow liquid	
Boiling point	> 100 °C	ASTM D 1120
Freezing point	-21.0 °C	ASTM D 1177
Density (20 °C)	1.340–1.345 g/cm <sup>3</sup>	DIN 51757
pH value (20 °C)	8.5–9.0	ASTM D 1287
Viscosity (20 °C)	4.0–5.0 mm <sup>2</sup> /s	DIN 51562

The above data represent average values that were valid when this Technical Information Bulletin went into print. They do not have the status of a product specification. Specified values are the subject of a special leaflet.

### Properties

As the name may suggest, **Calcium Chloride Special** is a cooling brine based on the food additive calcium chloride. Depending on the mixing ratio, blends of the product with water allow to achieve cooling limits below -50 °C. The heat transfer properties of **Calcium Chloride Special** are significantly better in comparison to glycol/water mixtures, and thus economical operation of refrigeration systems is rendered possible even at very low working temperatures. The non-toxic, odourless liquid contains specific corrosion inhibitors, stabilizers and buffers, and is free of borax, nitrites, phosphates and amines.

### Scope of Application

**Calcium Chloride Special** is used for cooling systems that mainly consist of non-alloyed steel. The cooling brine must **not** be applied for installations containing components made of aluminium, aluminium alloys or stainless steel. Please consult our technical department in any case of application-specific questions.

### Characteristics of Calcium Chloride Special/ water mixtures

CC Special 1.34 Concentrate	Lower cooling limit	Density (20 °C) (Product name)
39.5 vol. %	-10.2 °C	1.13 g/cm <sup>3</sup>
42.5 vol. %	-11.4 °C	1.14 g/cm <sup>3</sup>
48.5 vol. %	-14.2 °C	1.16 g/cm <sup>3</sup>
54.5 vol. %	-17.4 °C	1.18 g/cm <sup>3</sup>
60.5 vol. %	-21.2 °C	1.20 g/cm <sup>3</sup>
66.5 vol. %	-25.7 °C	1.22 g/cm <sup>3</sup>
73.0 vol. %	-31.2 °C	1.24 g/cm <sup>3</sup>
79.0 vol. %	-38.6 °C	1.26 g/cm <sup>3</sup>
85.0 vol. %	-50.1 °C	1.28 g/cm <sup>3</sup>
86.7 vol. %	< -50 °C	1.286 g/cm <sup>3</sup>
100 vol. %	-21.0 °C	1.34 g/cm <sup>3</sup>

### Application

Dilute **Calcium Chloride Special 1.34 Concentrate** with potable water or demineralised water to the required concentration or density, respectively. In order to maintain effective corrosion protection, the concentration of **Calcium Chloride Special** must not fall below

60.5 percent by volume (i.e. **Calcium Chloride Special 1.20**). All other data have been listed in the table for general information purposes only.

### Miscibility

**Calcium Chloride Special** must on no account be mixed with carbonate-containing brines, organic salt based secondary coolants or glycol/water mixtures, since this may lead to precipitation of solid material or chemical reactions occurring. Systems that were previously operated with other secondary coolants must be washed out and cleansed very thoroughly before refilling with **Calcium Chloride Special**.

### Temperature stability

**Calcium Chloride Special** is solely intended for application below 0 °C. Please consult our technical department in any case of application-specific questions.

### Compatibility with Sealing Materials

**Calcium Chloride Special** does not attack the sealing materials commonly used in refrigeration technology. Durable materials are, according to own testing and experience and literature data, hemp, sealants, and

Butyl rubber	IIR
Polyethylene, soft, rigid	LDPE/HDPE
Ethylene-propylene-diene rubber	EPDM
Polyethylene, crosslinked	PE-X
Epoxy resins	EP
Polypropylene	PP
Fluorocarbon elastomers	FPM
Polytetrafluoroethylene	PTFE
Natural rubber	NR
Nitrile rubber	NBR
Styrene-butadiene rubber	SBR
Polychlorobutadiene rubber	CR

An important point to note is that the performance of elastomers is not only governed by the properties of the rubber itself, e.g. EPDM, but also by the nature and amount of the constituent additives and the vulcanisation conditions. For this reason, it is recommended that their resistance to the secondary coolant is checked by performance tests before these materials are taken into use for the first time.

### Application guidelines

The following application guidelines must be strictly observed to achieve long-term corrosion protection for systems operated with **Calcium Chloride Special**.

**1.** We recommend to use **Calcium Chloride Special** in closed secondary loops. Otherwise contact with atmospheric oxygen will accelerate the consumption of the corrosion inhibitors. If an open circuit is used, however, it must be ensured that the return lines are situated below the surface level of the fluid to avoid any unnecessary entrainment of air. The pH value of the fluid must be checked more frequently as in case of closed systems.

**2.** A settling pot must be installed at the lowest part of the circuit to trap any washed down matter.

**3.** Piping must be installed so that no disruption of coolant circulation may occur due to the formation of gas pockets or deposits.

**4.** The level of the cooling brine must always be kept at the highest point in the circuit. A closed tank with a venting valve should also be installed at this point. Do not use automatic venting valves of a type that might allow air to enter the system.

**5.** Internally galvanized pipes or tanks must not be used. In case exterior galvanized coatings (e.g. cover plates, beams) have come into contact with the cooling brine, immediately wash down with plenty of water.

**6.** External surfaces of plant components that have been exposed to the product should be rinsed immediately with plenty of water and then dried using clean cloths. The use of warm water or steam improves the cleansing efficiency. Industrial floors are to be treated in the same manner.

**7.** It must be ensured that no external electrical potential exists between parts of the system that come into contact with the secondary coolant.

**8.** Dirt and water must not be allowed to enter the system or its components during installation or before it is filled. After the installation is finished, the system should be flushed out in order to remove any foreign material (swarf, scale, remains of packaging etc.) and other contaminants. After internal cleaning and a leak test have been carried out, the system must be emptied completely and immediately filled with the cooling brine to protect it from corrosion – even if the plant will be set into operation at a later date.

**9.** It must be ensured that no air pockets remain in the brine circuit after it has been filled. It is essential to eliminate any existing gas pockets, because their collapse following a drop in temperature would give rise to a vacuum and thus cause air to be sucked into the system. Insufficient deaeration of the brine circuit furthermore affects the efficiency of the system.

**10.** In-circuit filter elements must be cleaned within 14 days at the latest after the system was put into operation. This is necessary to ensure that neither obstruction to the fluid flow, nor malfunction of the system pumps might occur.

**11.** Fluid losses caused by leakage or removal from the system must be replaced by a **Calcium Chloride Special 1.34 Concentrate**/water mixture of equal concentration. In cases of doubt, the content of **Calcium Chloride Special** can be checked via density measurement (hydrometer).

**12.** We provide a check of the relevant fluid parameters, i.e. density, inhibitor concentration, pH value etc., upon request. A sample of 0.2 litres can be sent to our lab for initial analysis within one month after the system was set into operation. The client will receive a test report on the analytical results. Further samples should be sent after six months and one year of operation.

## Storage stability

**Calcium Chloride Special** has a shelf life of at least three years in airtight containers. The product must never be stored in galvanised containers.

## Delivery form and packaging

**Calcium Chloride Special** is available as a concentrate or ready-mix according to customer's specification. It is supplied in road tankers, in 1,000 litre IBCs, in 200 litre PE drums, and in 30, 20 and 10 litre non-returnable plastic cans.

## Disposal

Spills or leakages of **Calcium Chloride Special** must be taken up with an absorbent binder and disposed of in accordance with the regulations. For further information please refer to the Safety Data Sheet.

## Ecology

**Calcium Chloride Special** is classified in water hazard class 1, (low-rate endangering, Germany) according to current German water hazard regulations. The product does not cause any biological oxygen depletion in the event of a leakage into the environment.

## Handling

The usual safety and industrial hygiene measures relating to chemicals must be observed in handling **Calcium Chloride Special**. The information and instructions given in our Safety Data Sheet must be strictly observed.

## Safety Data Sheet

A current Safety Data Sheet in accordance with EU Directive 1907/2006/EC [REACH] is available on our website [www.tyfo.de](http://www.tyfo.de).

## Density of Calcium Chloride Special/water mixtures [kg/m<sup>3</sup>]

as a function of temperature and concentration

T [°C]	39.5 vol. %	42.5 vol. %	48.5 vol. %	54.5 vol. %	60.5 vol. %	66.5 vol. %	73.0 vol. %	79.0 vol. %	85.0 vol. %	86.7 vol. %
20	1130	1140	1160	1180	1200	1220	1240	1260	1280	1286
10	1133	1143	1164	1184	1204	1224	1245	1265	1285	1291
0	1136	1146	1168	1188	1208	1228	1249	1270	1290	1296
-10	1138	1148	1170	1190	1211	1231	1253	1274	1295	1301
-20	-	-	-	-	1213	1234	1256	1278	1299	1305
-30	-	-	-	-	-	-	1258	1280	1303	1309
-40	-	-	-	-	-	-	-	-	1305	1313
-50	-	-	-	-	-	-	-	-	-	1315

## Specific heat capacity of Calcium Chloride Special/water mixtures [kJ/kg·K]

as a function of temperature and concentration

T [°C]	39.5 vol. %	42.5 vol. %	48.5 vol. %	54.5 vol. %	60.5 vol. %	66.5 vol. %	73.0 vol. %	79.0 vol. %	85.0 vol. %	86.7 vol. %
20	3.370	3.320	3.224	3.123	3.052	2.981	2.918	2.860	2.805	2.784
10	3.345	3.295	3.199	3.098	3.027	2.956	2.893	2.835	2.780	2.756
0	3.320	3.270	3.174	3.073	3.002	2.931	2.868	2.809	2.755	2.728
-10	3.295	3.245	3.149	3.048	2.977	2.906	2.843	2.784	2.730	2.700
-20	-	-	-	-	2.952	2.881	2.818	2.759	2.705	2.680
-30	-	-	-	-	-	-	2.793	2.734	2.680	2.659
-40	-	-	-	-	-	-	-	-	2.654	2.638
-50	-	-	-	-	-	-	-	-	-	2.617

## Thermal conductivity of Calcium Chloride Special/water mixtures [W/m·K]

as a function of temperature and concentration

T [°C]	39.5 vol. %	42.5 vol. %	48.5 vol. %	54.5 vol. %	60.5 vol. %	66.5 vol. %	73.0 vol. %	79.0 vol. %	85.0 vol. %	86.7 vol. %
20	0.570	0.569	0.567	0.562	0.553	0.551	0.549	0.548	0.546	0.544
10	0.555	0.554	0.552	0.547	0.541	0.538	0.535	0.533	0.530	0.528
0	0.540	0.539	0.537	0.532	0.526	0.523	0.522	0.519	0.516	0.515
-10	0.525	0.524	0.522	0.517	0.513	0.511	0.508	0.506	0.504	0.502
-20	-	-	-	-	0.500	0.498	0.494	0.492	0.490	0.488
-30	-	-	-	-	-	-	0.480	0.478	0.477	0.476
-40	-	-	-	-	-	-	-	-	0.464	0.463
-50	-	-	-	-	-	-	-	-	-	0.450

## Kinematic viscosity of Calcium Chloride Special/water mixtures [mm<sup>2</sup>/s]

as a function of temperature and concentration

T [°C]	39.5 vol. %	42.5 vol. %	48.5 vol. %	54.5 vol. %	60.5 vol. %	66.5 vol. %	73.0 vol. %	79.0 vol. %	85.0 vol. %	86.7 vol. %
20	1.37	1.39	1.50	1.64	1.79	1.97	2.16	2.37	2.69	2.73
10	1.77	1.79	1.90	2.19	2.25	2.46	2.70	2.99	3.44	3.48
0	2.32	2.36	2.50	2.86	2.91	3.17	3.47	3.85	4.34	4.39
-10	3.14	3.18	3.40	3.86	4.48	4.91	5.43	6.02	6.80	6.95
-20	-	-	-	-	7.24	7.83	8.57	9.45	10.82	11.05
-30	-	-	-	-	-	-	12.00	13.67	16.65	17.23
-40	-	-	-	-	-	-	-	-	26.59	26.88
-50	-	-	-	-	-	-	-	-	-	38.78

## Dynamic viscosity of Calcium Chloride Special/water mixtures [mPa·s]

as a function of temperature and concentration

T [°C]	39.5 vol. %	42.5 vol. %	48.5 vol. %	54.5 vol. %	60.5 vol. %	66.5 vol. %	73.0 vol. %	79.0 vol. %	85.0 vol. %	86.7 vol. %
20	1.52	1.58	1.74	1.94	2.15	2.40	2.68	2.99	3.44	3.51
10	2.01	2.05	2.21	2.59	2.71	3.01	3.36	3.78	4.42	4.49
0	2.64	2.71	2.92	3.40	3.51	3.89	4.34	4.90	5.60	5.69
-10	3.57	3.65	3.98	4.59	5.43	6.04	6.80	7.67	8.80	9.04
-20	-	-	-	-	8.78	9.66	10.77	12.08	14.06	14.42
-30	-	-	-	-	-	-	15.10	17.50	21.70	22.55
-40	-	-	-	-	-	-	-	-	34.70	35.30
-50	-	-	-	-	-	-	-	-	-	50.99

## Prandtl numbers of Calcium Chloride Special/water mixtures

as a function of temperature and concentration

T [°C]	39.5 vol. %	42.5 vol. %	48.5 vol. %	54.5 vol. %	60.5 vol. %	66.5 vol. %	73.0 vol. %	79.0 vol. %	85.0 vol. %	86.7 vol. %
20	9.15	9.25	9.89	10.75	11.85	13.00	14.24	15.58	17.69	17.97
10	12.09	12.17	12.82	14.69	15.16	16.54	18.18	20.12	23.19	23.45
0	16.20	16.41	17.26	19.63	20.06	21.82	23.81	26.46	29.89	30.14
-10	22.43	22.61	24.00	27.08	31.48	34.37	38.08	42.20	47.70	48.63
-20	-	-	-	-	51.85	55.90	61.40	67.73	77.59	79.19
-30	-	-	-	-	-	-	87.84	100.08	121.89	125.99
-40	-	-	-	-	-	-	-	-	198.48	201.09
-50	-	-	-	-	-	-	-	-	-	296.57

### Note

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application these data do not relieve processors of the responsibility of carrying out their own tests and experiments, neither do they imply any legally binding assurance of certain properties or of suitability for a specific purpose. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislations are observed.



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