

100-Day Immersion Testing of ChemLINE® 784 in Ethylene Dichloride for Resistance Performance

Ethylene Dichloride (EDC) plays a crucial role in the industrial production of vinyl chloride monomer (VCM), an essential precursor in the polymerization process used to manufacture polyvinyl chloride (PVC). PVC is a versatile and widely used plastic, integral to many applications, including pipes, fittings, profiles, tubes, windows, doors, sidings, wire, cable, film, sheet, and flooring. Given the importance of EDC in the production chain, the safe and efficient transportation and storage of EDC are essential.

Summary

The ChemLINE® 784 Coating System was tested for its resistance to Ethylene Dichloride (EDC) (1,2-Dichloroethane, CAS 107-06-2) on behalf of a major customer and premier chemical company. The testing, a service routinely offered by APC, was conducted at Advanced Polymer Coatings' in-house laboratory, with BAM validating the reliability and accuracy of the results. The EDC used in these tests was supplied by GFS Chemicals and INEOS Inovyn. The immersion testing showed the coating's resilience to EDC over the span of a 100-day study, indicating ChemLINE® 784 to be the ideal coating for EDC storage and transportation.

To ensure the reliability of storing and transporting solutions for EDC, it is critical to evaluate the performance of coating systems designed to protect tanks from the chemical's potentially corrosive effects.

We believed ChemLINE® 784 was the perfect fit, as it is a high-performance coating system specifically engineered to withstand harsh chemical environments. To verify ChemLINE® 784's suitability for EDC service, we conducted a comprehensive 100-day immersion test, aimed to assess the coating's resistance to EDC containing different water concentrations, simulating real-world storage and transportation conditions.

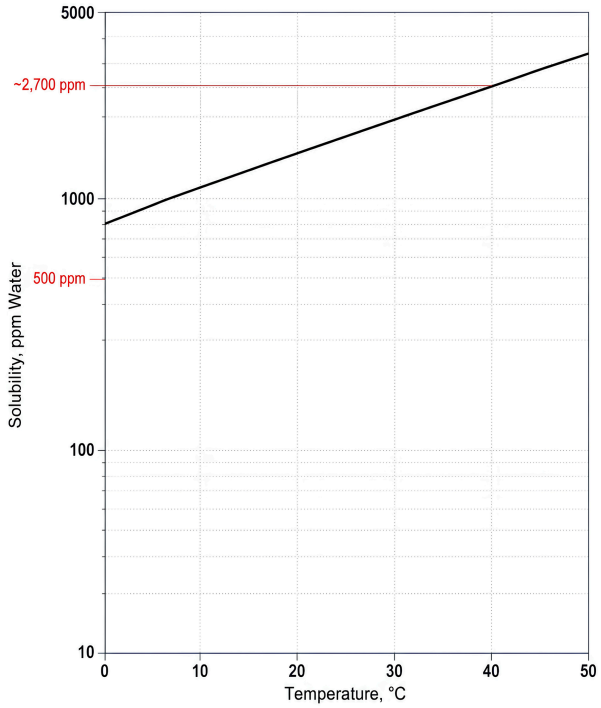
Validating our results, a scientific and technical federal institute, The Federal Institute for Materials Research and Testing (BAM) in Berlin, Germany, reviewed the study, and a test certificate was approved and issued.

Testing

Standard 2" x 5" test panels were sprayed with ChemLINE® 784 in accordance with APC specifications. The panels were prepared to provide a consistent coating surface for evaluation, helping ensure the results reflected the performance of the coating system rather than variation in application.

After coating, the panels were heat-cured at 122°C for the specified duration, following the recommended curing conditions for the system.

Figure 14: Solubility of Water in EDC Vs. Temperature



This controlled cure process is an important step in developing the coating's intended chemical resistance, adhesion, and overall performance properties prior to immersion testing.

Once cured, the panels were allowed to cool and were prepared for exposure testing. This ensured the samples entered the study in a properly applied and fully cured condition, providing a reliable basis for evaluating ChemLINE® 784 performance under the selected test environment.

Immersion Solutions

The following immersion solutions were prepared and maintained at 40°C for the duration of the tests:

1. EDC as received
2. EDC with 500 ppm water
3. EDC with 1% water
4. EDC with 5% water

NOTE:

Both the 1% and 5% water in EDC have a separate water layer because the solubility of water in EDC at 40°C is only 2,700ppm (0.27%) max.

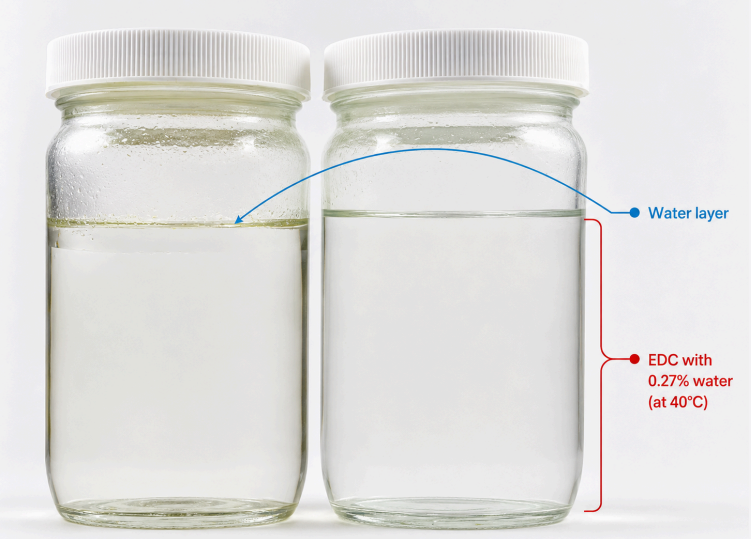
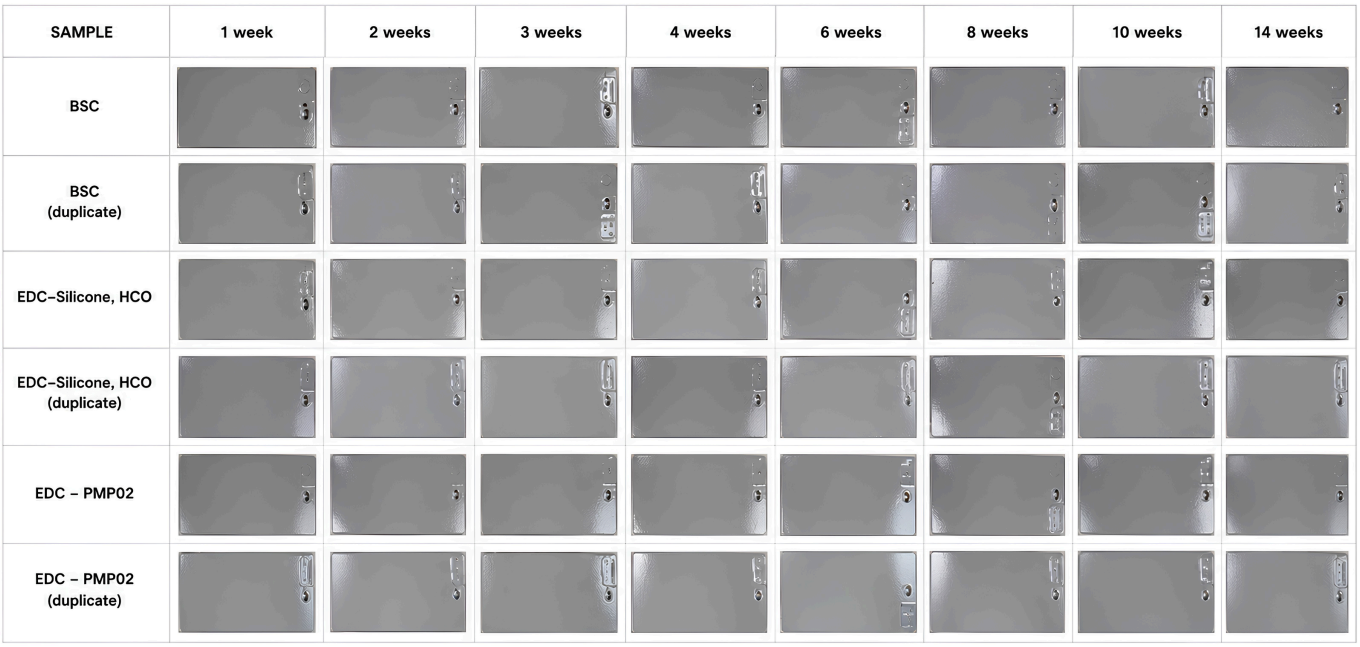


FIGURE 1.
PANEL PHOTOGRAPHS DURING EDC IMMERSION



Testing

The test panels underwent an immersion process in the respective EDC solutions, periodically removed during the 100-day study. Over each interval, the panels were dried in a fume hood, weighed, and visually inspected for defects.

The raw data from these immersions is compiled in the Immersion Results Table, shown right.

Photographic documentation of the panels was carried out during each weighing interval, which are presented above in Figure 1.

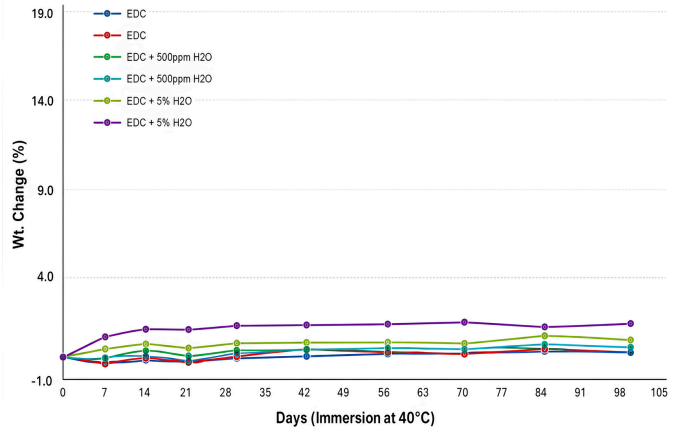
Figure 2 depicts the weight changes as a function of immersion time, providing an overview of the data.

Immersion Results:

ChemLINE 784/32
122C 6 hours
@40C

		Days									
		0	7	14	22	30	43	57	71	85	100
		10/17/23	10/24/23	10/31/23	11/08/23	11/16/23	11/29/23	12/13/23	12/27/23	1/10/24	1/25/24
EDC	Total Wt, g	150.7102	150.6916	150.6974	150.6963	150.7057	150.7212	150.7370	150.7401	150.8246	150.7864
	Wt Ctg, g		10.3517	10.3575	10.3564	10.3568	10.3813	10.3971	10.4002	10.4847	10.4465
	ΔWt g		-0.0186	-0.0128	-0.0139	-0.0045	0.0110	0.0268	0.0299	0.1144	0.0762
	ΔWt.(%)		-0.18%	-0.12%	-0.13%	-0.04%	0.11%	0.26%	0.29%	1.10%	0.73%
	mg/cm²		-0.1265	-0.0871	-0.0946	-0.0306	0.0748	0.1823	0.2034	0.7782	0.5184
EDC	Total Wt, g	151.8373	151.8203	151.8441	151.8180	151.8491	151.8795	151.8750	151.8634	151.8816	151.8762
	Wt Ctg, g		10.3533	10.3771	10.3510	10.3821	10.4125	10.4080	10.3964	10.4146	10.4092
	ΔWt g		-0.0170	0.0068	-0.0193	0.0118	0.0422	0.0377	0.0261	0.0443	0.0389
	ΔWt.(%)		-0.16%	0.07%	-0.19%	0.11%	0.41%	0.36%	0.25%	0.43%	0.38%
	mg/cm²		-0.1156	0.0463	-0.1313	0.0803	0.2871	0.2565	0.1776	0.3014	0.2646
EDC + 500ppm H2O	Total Wt, g	150.4502	150.4577	150.5043	150.4703	150.4972	150.4947	150.5053	150.5075	150.5034	150.5000
	Wt Ctg, g		10.3778	10.4244	10.3904	10.4173	10.4148	10.4254	10.4276	10.4235	10.4201
	ΔWt g		0.0075	0.0541	0.0201	0.0470	0.0445	0.0551	0.0573	0.0532	0.0498
	ΔWt.(%)		0.07%	0.52%	0.19%	0.45%	0.43%	0.53%	0.55%	0.51%	0.48%
	mg/cm²		0.0510	0.3680	0.1367	0.3197	0.3027	0.3748	0.3898	0.3619	0.3388
EDC + 500ppm H2O	Total Wt, g	151.2983	151.3018	151.3288	151.3023	151.3319	151.3441	151.3482	151.3513	151.3477	151.3301
	Wt Ctg, g		10.3738	10.4008	10.3743	10.4039	10.4161	10.4202	10.4233	10.4197	10.4021
	ΔWt g		0.0035	0.0305	0.0040	0.0336	0.0458	0.0499	0.0530	0.0494	0.0318
	ΔWt.(%)		0.03%	0.29%	0.04%	0.32%	0.44%	0.48%	0.51%	0.48%	0.31%
	mg/cm²		0.0238	0.2075	0.0272	0.2286	0.3116	0.3395	0.3605	0.3361	0.2163
EDC +1%H2O	Total Wt, g	150.9000	150.9674	150.9871	150.9876	150.9996	151.0012	150.9967	150.9727	150.9903	150.9601
	Wt Ctg, g		10.4377	10.4574	10.4579	10.4699	10.4715	10.4670	10.4430	10.4606	10.4304
	ΔWt g		0.0674	0.0871	0.0876	0.0996	0.1012	0.0967	0.0727	0.0903	0.0601
	ΔWt.(%)		0.65%	0.84%	0.84%	0.32%	0.98%	0.93%	0.70%	0.87%	0.58%
	mg/cm²		0.4585	0.5925	0.5959	0.6776	0.6884	0.6578	0.4946	0.6143	0.4088
EDC+5%H2O	Total Wt, g	150.0006	150.0996	150.1364	150.1274	150.1479	150.1501	150.1527	150.1555	150.1417	150.1606
	Wt Ctg, g		10.4693	10.5061	10.4971	10.5176	10.5198	10.5224	10.5252	10.5114	10.5303
	ΔWt g		0.0990	0.1358	0.1268	0.1473	0.1495	0.1521	0.1549	0.1411	0.1600
	ΔWt.(%)		0.95%	1.31%	1.22%	1.42%	1.44%	1.47%	1.49%	1.36%	1.54%
	mg/cm²		0.6735	0.9238	0.8626	1.0020	1.0170	1.0347	1.0537	0.9599	1.0884

FIGURE 2.
EDC IMMERSION, WEIGHT CHANGE VS. IMMERSION TIME @ 40°C



ChemLINE®

Conclusion

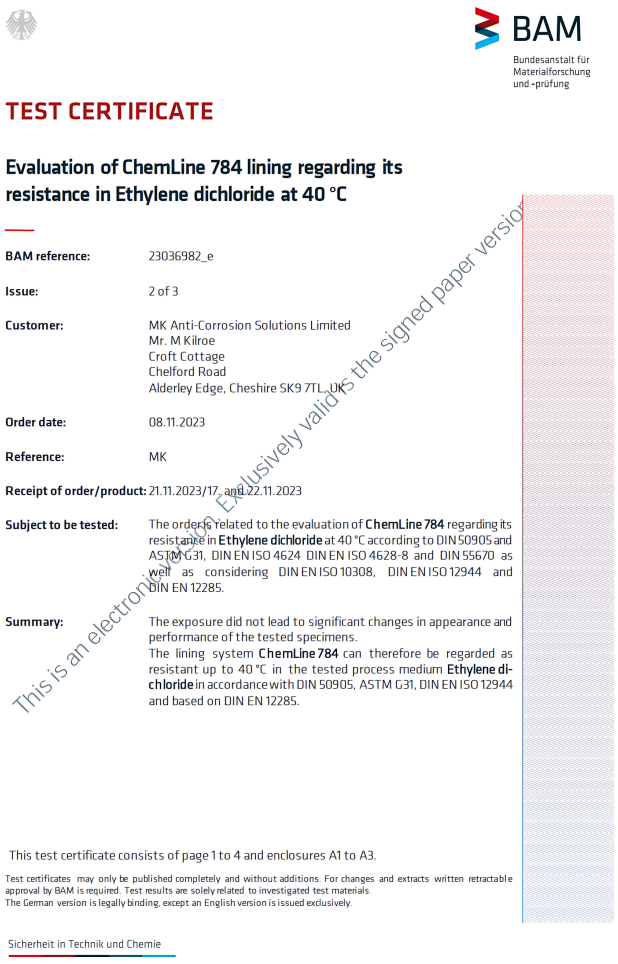
The data shows that the weight gain for all ChemLINE® 784 samples exposed to EDC solutions was less than 2%, and the weight gain for panels immersed in neat EDC and EDC containing 500 ppm water was less than 1%. These findings, which surpass the acceptable test result defined by a weight gain of less than 15%, provide strong evidence that ChemLINE® 784 is highly resistant to EDC and EDC solutions with different amounts of water when properly applied and heat cured.

The visual inspections, supported by the images in Figure 1, also verify these findings. The panels were inspected for discoloration, blistering, cracking, and peeling throughout the immersion period, and no defects were found, validating the coating's durability. Likewise, the panels retained their original gloss and appearance, further affirming the coating's resistance.

In addition to the in-house testing, third-party validation by **BAM Certification Body (BZS)** confirmed the suitability of ChemLINE® 784 for EDC service. The coating met the requirements of DIN 50905, ASTM G31, DIN EN ISO 12944, and DIN EN 12285, verifying its resistance up to 40°C in Ethylene Dichloride.

With APC's in-house laboratory, ChemLINE® 784 coating was tested for its suitability for EDC solutions. Based on the test results, verified by BAM, APC recommends the use of ChemLINE® 784 in EDC services with utmost confidence.

Mimicking the real-world environment through a 100-day immersion test, the coating's proven resistance to EDC containing different water concentrations demonstrates ChemLINE® 784 to be the optimal choice for the safe transportation and storage of EDC.



BAM
Bundesanstalt für Materialforschung und -prüfung

TEST CERTIFICATE

Evaluation of ChemLine 784 lining regarding its resistance in Ethylene dichloride at 40 °C

BAM reference: 23036982_e

Issue: 2 of 3

Customer: MK Anti-Corrosion Solutions Limited
Mr. M Kilroe
Croft Cottage
Chelford Road
Alderley Edge, Cheshire SK9 7TL, UK

Order date: 08.11.2023

Reference: MK

Receipt of order/product: 21.11.2023/17, and 22.11.2023

Subject to be tested: The order is related to the evaluation of **ChemLine 784** regarding its resistance in **Ethylene dichloride** at 40 °C according to DIN 50905 and ASTM G31, DIN EN ISO 4624 DIN EN ISO 4628-8 and DIN 55670 as well as considering DIN EN ISO 10308, DIN EN ISO 12944 and DIN EN 12285.

Summary: The exposure did not lead to significant changes in appearance and performance of the tested specimens.
The lining system **ChemLine 784** can therefore be regarded as resistant up to 40 °C in the tested process medium **Ethylene dichloride** in accordance with DIN 50905, ASTM G31, DIN EN ISO 12944 and based on DIN EN 12285.

This is an electronic version. Exclusively valid is the signed paper version.

This test certificate consists of page 1 to 4 and enclosures A1 to A3.

Test certificates may only be published completely and without additions. For changes and extracts written retractable approval by BAM is required. Test results are solely related to investigated test materials.
The German version is legally binding, except an English version is issued exclusively.

Sicherheit in Technik und Chemie

Contact a member of the APC ChemLINE® Team to ensure your operation is protected properly with tailored, in-house lab testing.