Oil & Gas

Technical Information

UCARSOL™ HS 103 Solvent

For Selective H_2S Removal

Introduction

UCARSOL™ HS 103 solvent, one of a series of high-performance gas treating solvents from The Dow Chemical Company, is designed specifically for use in tail gas treating processes. UCARSOL HS 103 solvent selectively removes H_2S in preference to CO_2. This product has been specially formulated to achieve very low levels of H_2S, even in the demanding low-pressure conditions found in tail gas units. It can also eliminate the incineration operation associated with tail gas units.

Its high selectivity, coupled with the ability to reduce H_2S to the minimal levels dictated by environmental regulations, makes UCARSOL HS 103 solvent particularly well-suited for tail gas units. By eliminating the need to incinerate effluent gas streams, customers can realize significant operating and capital cost savings.

The selectivity of UCARSOL HS 103 solvent is excellent to such commonly used selective solvents as diisopropanolamine (DIPA) and methyldiethanolamine (MDEA). However, being an MDEA based solvent, its physical properties are similar to MDEA.

Special Features

UCARSOL™ solvents offer these important special advantages:

- Significant energy savings through reduced reboiler duty, decreased pumping requirements because of lower solvent circulation, and elimination of solvent reclaiming
- Reduced solvent loss because of low foaming tendency and lower solvent vapor pressure
- Increased acid gas processing ability with existing facilities
- Technical support and complete solvent services ensure on-going, trouble-free operation

Corrosion Effects

The results of various heat transfer and laboratory corrosion tests on stainless and mild steels, as well as actual field experience in numerous operating units, indicate that UCARSOL™ HS solvents, if used correctly, exhibit virtually no corrosion when used with stainless and other mild steels.

Physical Properties

UCARSOL HS 103 solvent can be used as aqueous solutions in various concentrations. However, a 50 percent aqueous solution has been found to offer the optimal performance. Physical property data for pure and 50 percent aqueous solutions of UCARSOL HS 103 solvent have been developed and are presented below.

Additional information on UCARSOL HS 103 solvent, its properties and advantages, is available on request. To discover what UCARSOL HS 103 solvent can do for your existing or proposed gas treating unit, contact Dow.

Table 1 • Physical Properties of UCARSOL™ HS 103 Solvent

Average Weight per Gallon at 20°C, lb Average Weight per Liter at 20°C, kg	8.983 1.0767
Δ lb per Gallon/Δt Δ lb per Liter/Δt	0.00669 per °C 0.00677 per °C
Boiling Point, °C at 760 mm Hg at 50 mm Hg at 10 mm Hg	 156.7 83.3 1.5
Coefficient of Expansion at 20°C at 55°C	 0.00076 per °C 0.00075 per °C
Pour Point °C pH at 25°C	-44 10.2
Thermal Conductivity at 25°C, Btu/hr•ft^2•°F/ft (Kcal/hr•m^2•°C/m)	0.0901 (0.134)
Solubility in Water at 20° of Water in at 20°	 Complete Complete
Flash Point, °C (°F) Pensky-Martens Closed Cup, ASTM D93 Cleveland Open Cup, ASTM D92	 255 (124) 290 (143)

Temperature °C	Specific Gravity t/20°C	lb/gal (kg/L)	Viscosity cP
0	1.0899	9.080 (1.0882)	1083.0
20	1.0784	8.983 (1.0767)	221.1
40	1.0616	8.844 (1.0599)	65.4
60	1.0471	8.723 (1.0454)	24.8
80	1.0321	8.598 (1.0305)	11.3

Table 2 • UCARSOL™ HS 103 Solvent, Specific Heat vs. Temperature

Temperature °C	Specific Heat, cal/g°C	Temperature, C°	Specific Heat, cal/g°C
0	0.5200	60	0.5980.0
10	0.5336	70	0.6102
20	0.5470	80	0.6221
30	0.5601	90	0.6338
40	0.5730	100	0.6453
50	0.5856	120	0.6674
		140	0.6887

Table 3 • Physical Properties of 50% by Weight Aqueous UCARSOL™ HS 103 Solvent

Boiling Point, °C at 760 mmHg at 50 mmHg at 10 mmHg	 104.0 42.5 16.9
Freezing Point, °C (°F)	-22
pH at 25°C	10.0
Thermal Conductivity at 25°C, Btu/hr•ft$_2$•°F/ft (Kcal/hr•m$_2$•°C/m)	0.263 (0.392)
Solubility in Water at 20° of Water in at 20°	 Complete Complete

Temperature °C	Specific Gravity t/20°C	lb/gal (kg/L)	Viscosity cP
0	1.0729	8.938 (1.0712)	32.9
20	1.0629	8.855 (1.0612)	11.1
40	1.0536	8.777 (1.0519)	5.0
60	1.0406	8.669 (1.0389)	2.7
80	1.0254	8.542 (1.0238)	1.7

Table 4 • 50% by Weight of Aqueous UCARSOL™ HS 103 Solvent, Specific Heat vs. Temperature

Temperature °C	Specific Heat, cal/g°C	Temperature °C	Specific Heat, cal/g°C
0	0.8272	60	0.8810
10	0.8350	70	0.8916
20	0.8432	80	0.9027
30	0.8519	90	0.9143
40	0.8611	100	0.9264
50	0.8708	120	0.9520
		140	0.9796

Gas Treating Services

Dow is a worldwide leader in providing gas treating processors with technology and specialized services. To aid in both plant design and operation, UCARSOL™ solvents are supported under the umbrella of AMINE MANAGEMENT℠ Program from Dow Oil & Gas, with advanced computer capabilities, state-of-the art laboratory, field test equipment, analytical procedures and an ongoing optimization program. The services we provide encompass preliminary assessments, start-up services, continuous monitoring and follow-up services. Included in this total support program are the training of field personnel, regular sample testing and performance evaluation. To ensure complete customer protection and satisfaction, Dow is there every step of the way – before, during and after installation.

Computer Capabilities

With information drawn from actual operating conditions of over 800 plants, Dow has an extensive formulated solvent database used to optimize the simulation programs used in design. This sophisticated computer program provides a powerful tool for process analysis and design, including tray-by-tray calculations. Hydraulic evaluations can be made of existing trayed or packed towers to ensure that conversion to UCARSOL™ solvents will be trouble-free.

Field representatives have the latest equipment and programs that make it possible to predict the performance of UCARSOL solvents under actual plant conditions. In addition, their use as an in-field preliminary design tool is extremely valuable after conversion to make any adjustments necessary to optimize the process.

Sample Kits

Dow offers a unique sample kit. Completely self-contained, the kit provides everything necessary—from containers to labels—to obtain lean and rich amine samples, and seal and safely ship them for routine analysis.

Other Services

Dow's engineering expertise is also available to provide information on process and equipment requirements. Our corrosion group can also assist in field inspections or set up corrosion-monitoring programs for customers. In addition, Dow can train customer personnel prior to and during conversion, following-up with them to ensure optimal performance.

Figure 1 • Specific Gravity of Pure and Aqueous UCARSOL™ HS 103 Solvent

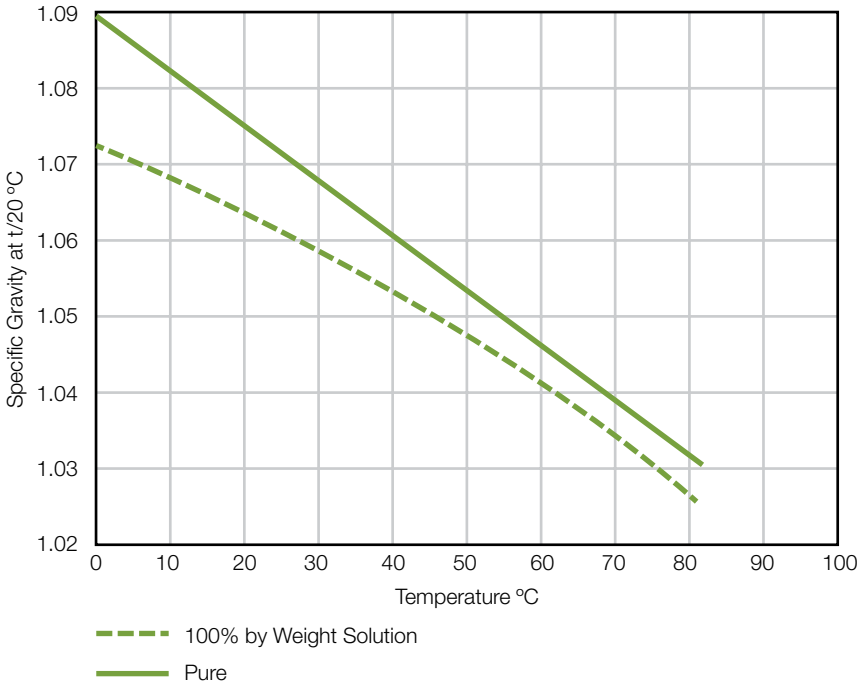


Figure 2 • Weight per Gallon of Pure and Aqueous UCARSOL™ HS 103 Solvent

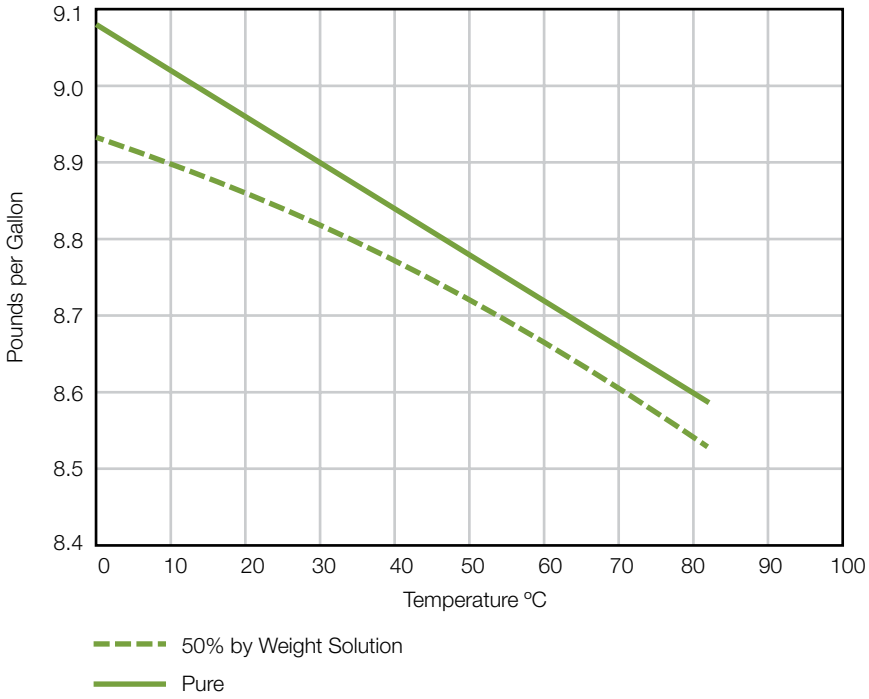


Figure 3 • Viscosity of Pure and Aqueous UCARSOL™ HS 103 Solvent

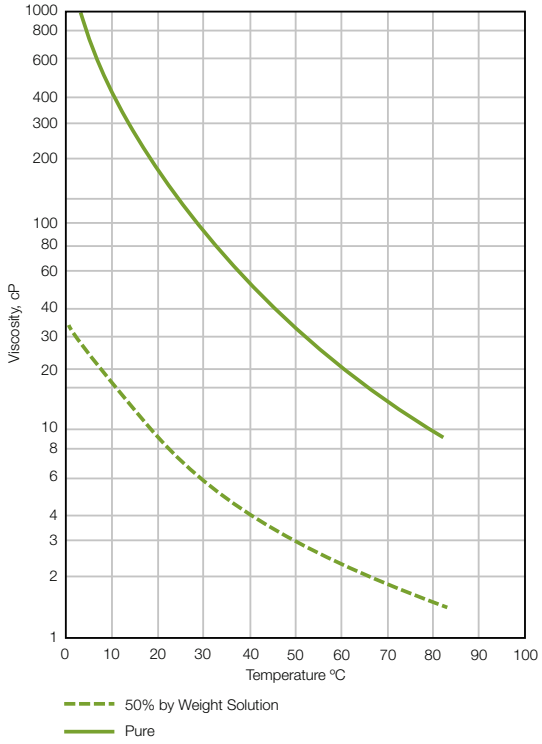
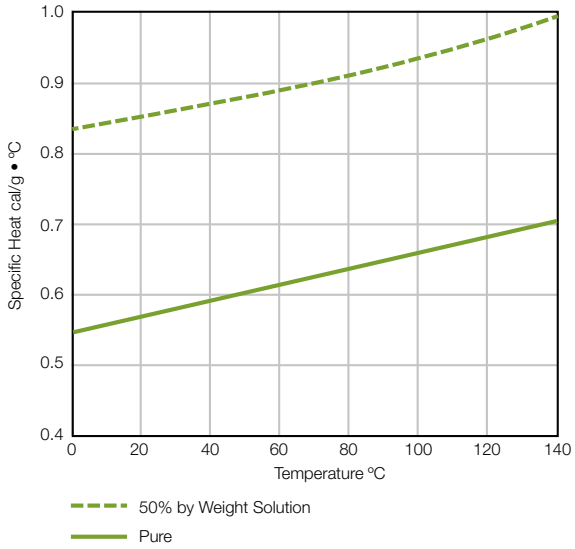


Figure 4 • Specific Heat of Pure and Aqueous UCARSOL™ HS 103 Solvent



Storage and Handling

UCARSOL™ HS 103 solvent is usually stored and handled in steel equipment. It is also compatible with tinned steel, aluminum, and stainless steel. Zinc or galvanized steel and copper and its alloys should not be used.

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This product becomes viscous at outside winter temperatures and has a pour point of -44°C (-47.2F°). Therefore, storage inside a warm building or in a heated, insulated tank may be desirable. A centrifugal pump is suitable for transfer service, assuming the temperature of the product is sufficiently above its pour point. A rotary or gear pump is suggested for low-temperature transfers.

Piping should be of adequate size to handle the maximum viscosity. Valves, piping, etc. are usually of steel construction. 304 stainless steel, spiral wound Grafoil gaskets for flanges and Grafoil packing for valves is recommended. For O-rings, EPR is recommended below 50°C (122°F), and Kalrez above 50°C (122°F). Do not use Viton or Buna-N elastomers.

Aqueous solution of UCARSOL™ HS 103 solvent can be handled in steel equipment. They should not be handled or stored in contact with aluminum, zinc or galvanized iron, and copper and its alloys.

Table 5 • Ecological Fate and Effects of UCARSOL™ HS 103 Solvent

Chemical Oxygen Demand (COD), mg O_2/mg	1.27
Biochemical Oxygen Demand (BOD), % Biooxidation Day 5 Day 10 Day 20	 2 76 118_a
Bacterial Inhibition, IC_{50}, mg/L	>5000
Aquatic Toxicity, LC50, mg/L Fathead Minnows, 96-hr	 1359

a>100% indicates nitrification

Environmental Effects

Dow has carried out a series of laboratory studies on the biodegradation and ecological effects of UCARSOL HS 103 solvent. These tests were conducted by procedures that follow the most recent EPA/ASTM/Standard Methods techniques.

Product Stewardship

When considering the use of any Dow products in a particular application, you should review Dow's latest Material Safety Data Sheets and ensure that they are intended for safe use. For Material Safety and Data Sheets and other product safety information, contact Dow. Before handling any other products mentioned in the text, you should obtain available product safety information and take necessary steps to ensure safety of use.

No chemical should be used as or in a food, drug, medical device, or cosmetic, or in a product or process in which it may contact a food, drug, medical device, or cosmetic until the user has determined the suitability and legality of the use. Since government regulations and use conditions are subject to change, it is the user's responsibility to determine that this information is appropriate and suitable under current, applicable laws and regulations.

Dow requests that the customer read, understand, and comply with the information contained in this publication and the current Material Safety Data Sheet(s). The customer should furnish the information in this publication to its employees, contractors and customers, or any other users of the product(s), and request that they do the same.

To Learn More...

U.S., Canada, Mexico: Phone: 1-800-447-4369 Fax: 989-832-1465

Latin America: Phone: +55 11-5188-9222 Fax: +55-11-5188-9749

Europe: Phone Toll Free: +800-3-694-6367*

Phone: (+32) 3-450-2240 Fax: +32 3-450-2815

Asia Pacific: Phone Toll Free: +800 7776-7776*

Phone: (+60) 3-7958-3392 Fax: +60 3 7958 5598

Middle East and North Africa: Phone: +971 4 332 8866

Fax: +971 4 332 8280

Cairo, Egypt: Phone: +202 2 480 1465 Fax: +202 2 480 1478

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Note: This guide is designed as a general product overview. Please contact your local Dow Oil & Gas representative for up-to-date, detailed technical information including registrations and use limitations and to discuss individual applications or requirements.

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