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NEWSLETTER

HEGGEL® Corr 210

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Slug Catchers

Large quantities of multiphase oil and gas flow in a pipeline often result in the formation of a much heavier, slow-moving fluid, known as Slug, with higher density compared to the main body of the flow. Effective separation of different impurities from oil and gas in upstream operations is a matter of paramount importance; since the efficiency of processing equipment and downstream activities is highly dependent on the purity level obtained at first stages.

Located between the outlets of pipelines and processing units, slug catchers are the first stage in upstream processing plant designed to buffer two-phase flow slugs; minimizing the slug from oil and gas pipelines. In fact, the slug catcher is a separator of heavy liquid hydrocarbons and the gaseous compounds, where the gas is routed from the top of the slug catcher for further processing while the liquids are directed to condensate flow line. Designed in various types such as Vessel, Finger, Stored Loop and Hybrid, Slug catchers effectively protect downstream equipment and pipelines from destructive liquids, while reducing downtime and maintaining production.

Fluids extracted from oil and gas are composed of crude oil, water, natural gas, salt compounds, etc. Although hydrocarbons are not severely corrosive, a synergy of corrosion mechanisms are responsible for the commonly observed corrosion defects. Slug catchers are therefore seriously susceptible to internal corrosion and/or erosion as a consequence of metal ion concentration under debris, corrosive agents including CO2(aq), H2S(aq), chlorides, oxygen, scale, solids, bacteria and galvanic effects of the weld microstructural and/or compositional differences with the parent metal. Also, severe pitting corrosion is observed mainly along the bottom of the line under slug or accumulated deposits resulting in a drastic loss of wall thickness in the pipes.

This case study is based on a project in a gas refinery in Middle East, focused on repairing the corrosion-damaged areas of the gas pipeline system in a slug catcher unit, specifically on the condensate equalizer line.

Description of Project Status

Inspection to determine the presence of any unforeseen pitting corrosion revealed a widespread issue with heavy corrosion along the pipeline and the 90-degree elbow on internal surfaces. Due to the H2S-containing Hydrocarbon Condensate at continued high operating pressure of 75 barg, corrosion was severely intensified to depth-extending pitting. Being 4 years in service, there were local metal loss areas shaped like isolated islands throughout the length of the pipe. Based on NDT inspection results, serious corrosion defects were detected at 6 o'clock position. More validations on external findings also showed that the most severe corrosion was confined to the bottom of the pipe where the wall loss was estimated as 10 mm creating a critical condition. Due to the subsequent integrity assessments, the slug catcher was not fit for continued operation at this excessive rate of pitting. Also, the remaining wall thickness was estimated at only 2.5 mm, justifying the decision to de-rate the system; since further corrosion could not be tolerated at the original design pressure of 139 bar.

Due to the explosive overpressure, the associated risk of fatal incidents and also heavy destructions in process facilities, maintenance operation was urgently required to prevent leaks, explosion and potential loss of containment while extending the operating life of the equipment.

Furthermore, slug catchers have the potential to release large amounts of hydrocarbons causing environmental contaminations, and damages beyond the plant boundaries if ignited. Slug Catcher failure would also result in loss of total LNG and condensate production. Moreover, huge expenditures for outright replacement of the equipment are of economic consequences.

Here, the repair procedure was necessary to be carried out in the shortest time possible, out of overhaul schedule while the process line was in service to maintain the production level.

Pipe Information

Oil & Gas Pipeline/Slug catcher unit	
Pipe diameter	10 inches
Nominal wall thickness	12.7 mm
Amount of wall loss	~10.16 mm
Product in pipe	Hydrocarbon Condensate
Operating pressure	75 barg
Operating temperature	30°C

HEGGEL® Corr 210

Reliable High-Tech Solution for Reinforcing Damaged Areas

HEGGEL GmbH has been distinguished by providing reliable custom designed solutions in projects with complicated process conditions including harsh chemical environment, extreme mechanical challenges, severe operational conditions, etc.

Having the process conditions intently examined in order to construct a course of action for slug catcher maintenance at high-risk areas, a reinforcement of condensate equalizer line was defined to be implemented using **HEGGEL Corr 210** combined with 3 layers of glass fiber to optimize long-term mechanical strength, withstanding high operating pressure and the resulted vibrations in addition to providing excellent corrosion protection.

HEGGEL Corr 210 is an advanced polymer coating featured by long-range durability, providing impermeable surface finish with high performance protective effect based on its unique molecular structure. Outstanding tensile and compressive strength in addition to considerable flexural strength is of other high-end qualities of **HEGGEL Corr 210**, making it an optimized choice for extreme protection. Characterized with this extraordinary physical and chemical properties, **HEGGEL Corr 210** best met all the requirements in the defined project.

General Technical Data

Recommended Product: HEGGEL® Corr 210 Two-Component High-Tech Corrosion Resistant Coating	
Tensile Strength BS 6319: Part 7: 1985	35.3 MPa
Flexural Strength BS 2782: Part 10 Method 1005: 1977	59.43 MPa
Compressive Strength BS6319: Part 2: 1983	111.3 MPa
Volume solids	100%
Impact Resistance ASTM G14	Forward: 13 Joules Reverse: 3 Joules
Adhesive Strength ASTM D4541	29.3 MPa (cohesive failure)
Temperature Resistance NACE TM0174	+190°C Immersed +250°C Non-Immersed
Abrasion Resistance ASTM D4060	20 mg weight loss (Tabor CS-17/1kg/1000 cycles)
Salt spray test ASTM B117 & D714	>20000 hrs
Cathodic disbondment ASTM G95/G42/G8	No disbondment

Application

Surface Preparation

In order to deliver superior results from high performance coating systems, specifically for good wet adhesion of the coating, surface preparation is a vital prerequisite.
In this regard, for the first step the previous paint was thoroughly stripped away using manual sand blasting. After the complete paint removal, to promote adequate surface roughness, light blasting was performed manually and using abrasive discs by powered sanders with medium power impacts to prevent unwanted surface imperfections and protrusions removal.
For the next step, degreasing was conducted both safely and effectively using Xylene and Acetone to remove oil-based contaminations; MEK solution was also used as an excellent heavy-duty cleaning agent.
During the surface preparation process the pipe was depressurized and the entire steps were performed with slow-speed and great caution.

Installation Process

After carrying out the surface preparation steps fully in compliance with HSE requirements on both application procedure and equipment, installation process was initiated by applying the first layer of HEGGEL Corr 210 thoroughly on the treated surfaces to approx. 1 mm thickness using spatula. Then the single layer of 300 gr/m^2 woven roving glass fiber was laid entirely in the coating, wrapping around the pipe. Afterwards HEGGEL Corr 210 was added to the surface with approx. 1 mm thickness and the embedded fiber was completely immersed in the coating.

After the installation of the first layers, it took nearly four hours for the combined system to semi-cure and be prepared for the next steps of the implementation process. To composite the next layers, the blasting operation was required to lightly roughen the semi-cured surface without removing a significant amount of the first applied coating to promote adhesion of the new layers. Here, light sweep blasting was continued until the adequate roughness was achieved and surface preparation standards were met. In order to get the protective system fully constructed with 6 coating layers, the first step of the installation process, i.e., the composition of Coating-Fiberglass-Coating, was re-performed two more times. Due to the temperature decrease during the night-shift operations, the drying time was increased up to 8 hours. Also, in order to have an optimized finishing, the gel coat thickness was increased to approx. 2 mm.

It is noteworthy to mention that not only the installation process of HEGGEL Corr 210 composite fully adhered to the highest safety standards, it was also performed within a very short time per customer‘s demand, taking into account that the unit should not be overhauled out of schedule. Based on results from later inspections, the applied HEGGEL Corr 210 system is in great condition and no deficiencies have been detected after several months.