

1. OVERVIEW OF ACIDISATION

- Rust scale (Fe_2O_3) reacts with hydrogen chloride (HCl) liberated from chloride promoter to form moisture
- Moisture causes permanent deactivation of chlorided alumina catalyst (1 kg water kills 80-100 kg catalyst)
- Purpose of acidisation is to remove rust scale before startup to avoid permanent catalyst deactivation
- Achieved by injecting slugs of anhydrous HCl gas into reaction section ($\text{Fe}_2\text{O}_3 + 6\text{HCl} \rightarrow 2\text{FeCl}_3 + 3\text{H}_2\text{O}$)
- Acidisation step is preceded by initial drydown step and followed by final drydown step
- Duration for acidisation step depends on amount of rust scale (eg. unit turnaround vs new-build unit)
- Typical acidisation step duration after unit turnaround if care taken to avoid water ingress is 1 - 2 days
- Rule of thumb for quantity of anhydrous HCl required is 570 kg/km^3 feed for new (10 - 25% for turnaround)

2. ANHYDROUS HCl INJECTION SET-UP

- Specialty gas vendors make anhydrous HCl in several purity grades – commercial grade is adequate
- Vendor will supply anhydrous HCl in pressurised bottles or large skid-mounted cylinders (“Y cylinders”)
- If a “Y cylinder” is used, be sure to connect to the vapour phase outlet rather than liquid phase outlet
- Other equipment required is weigh scale, caustic-filled drum, HCl pressure regulator and piping/fittings
- Fittings should include check valve at process end, quick shutoff valves at both ends, vent and drain
- Injection manifold/piping may be carbon steel pipe or stainless steel tubing (no brass fittings allowed)
- Injection system should be pressure tested after installation with high pressure nitrogen to verify integrity
- Personnel protective equipment (PPE) to include chemical-resistant suit and fresh air supply with mask
- Install barriers around anhydrous HCl injection skid to exclude personnel not wearing appropriate PPE
- Ensure availability of spare probes for moisture analyser and analyser technicians to provide 24 hr cover
- Check in advance that all low point drain valves are operable and replace at turnaround if necessary



Fig 1: Ensure gas bottles are firmly secured



Fig 2: Chemical-resistant suit and fresh air



Fig 3: Ensure spare moisture probes available



Fig 4: Use caustic to neutralise vent discharge

3. ANHYDROUS HCl INJECTION

- Acidisation starts when initial drydown achieves 10 ppmwt moisture in Product Separator liquid
- Isolate moisture analyser(s) during HCl injection to avoid damaging moisture probe(s)
- Inject HCl in 5 kg slugs over 10 min period (to minimise corrosion) using weigh scale to monitor rate
- Block in HCl injection system at Y cylinder and injection point to ensure no vapourisation after slug
- After approx 1 hr, use colorimetric (“sniffer”) tube to measure HCl in Product Separator gas stream
- Check drains regularly and re-commission moisture analyser when Product Separator gas HCl < 10ppmv
- If Product Separator liquid stream moisture > 1 ppmwt, isolate analyser and repeat HCl slug injection