

STANDARD WORK INSTRUCTION (SWI)

Application of Polyurethane Resin (PUR) and Urea Silicate Resin (USR)

What is needed for this standard work instruction (SWI)?

OK?

Isolation and Control of energy

- As per site isolation procedure GRO-241-SOP-Control of Energy
- Isolation of equipment where required
- De-energise stored energy in hoses before disconnecting

Competencies and Skills

- Longwall panel familiarisation (Underground and Surface Induction)
- Relevant authorisation to operate and maintain the equipment
- Polymeric chemical (Polyurethane - PUR, Urea Silicate - USR) familiarisation awareness training
- Familiarisation with this SWI
- Health surveillance (polymeric chemical medical) is compliant as per Recognised Standard 16 (The Use and Control of Polymeric Chemicals at Underground Coal Mines).

Mandatory Labour Requirements

All personnel performing the task are to be trained and approved to conduct the task of application of PUR and USR and be signed off for any piece of equipment required to complete the task. Site supervisor is to confirm this prior to the task being undertaken.

The following competencies are required:

- Trained in use of application pump – Practical assessment for DP40 pump
- Crew have completed Polymeric Chemical familiarisation training level 1 (PUR, USR, Phenolics).
- Applicators minimum operator level 2 or under Training with application operator level 2.
- Health surveillance (polymeric chemical medical) is compliant as per Recognised Standard 16 (The Use and Control of Polymeric Chemicals at Underground Coal Mines).

All personnel have reviewed and understand the procedure before undertaking the task.

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Equipment and Tools

Equipment Required:

- DP40 pump and pod (which includes tools/ PPE)
- Sufficient A and B components
- Chemical pods for transportation of resin underground
- Air and water hoses
- Pump flushing agent
- Associated spare parts
- Injection hoses, nozzle, hose fittings
- PPE
- Spill kit (attached to each chemical pod)
- Absorbent material for spills (supplied by mine)
- Firefighting equipment (Dry agent, carbon dioxide, foam or water fog extinguishers, water hose set and ready)
- Equipment pre-start check list
- Injection reports
- Random polymeric health testing is conducted as per polymeric HMP
- SHE report forms – SLAM, JSEA, PTW etc.
- Caution/barrier tape, reflective droppers and signage
- Isolation locks
- First aid kit at pump and nozzle
- Diphoterine located at the pump and nozzle
- Pogo sticks (if required)
- Brattice / Tech Mesh (if required)
- Hose pod (including consumables) (If required)
- SDS for all products

NOTE: All equipment must be inspected prior to use – All defects to be listed on the prestart inspection checklists and given to your supervisor or maintenance personnel. Defective equipment shall not be used under any circumstances

Non-standard PPE















- PPE in accordance with the SDS within the zone of operations and while transporting and/or handling containers or equipment.

Mandatory PPE

Chemical gloves (Viton or Nitrile), chemical resistant coveralls, chemical goggles & chemical resistant boots.

Optional PPE requirements:

- GP1 Organic Vapour masks if inhalation risk is present (burst hose etc).

						
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Note: Skin absorption is the main route of exposure. Avoid skin contact!

Barrier Cream should be used to help prevent skin conditions associated with the work.

Where excessive exposure is likely or large spills are being managed then the Type C chemical overalls are to be used (available in spill kits and pump pod).

In the event of a splash on overall or any other disposable PPE, and there is a risk of skin contact observed, discard PPE and put on a new set on, all rubbish contaminated with raw products are to be removed to surface and placed in the contaminated waste bins provided.

Correct manual handling techniques to be used, remember mechanical aids can be used.

Do not touch face or eyes with contaminated clothing, PPE or hands as they may contain traces of chemicals.

Do not stand directly in line with any hole or place where resin may be ejected.

Only personnel with the appropriate product familiarisation training are allowed in ZOO.

Special Hazards

- Chemical Exposure/contaminations from spills, inhalation or contact during pumping.
- Skin irritation
- High pressured hoses
- Strata failure
- Potential fire
- Overheating
- Heat stress
- Ventilation
- Equipment interaction

Other Matters

- Post application inspections for heating to be conducted
- Statutory official to inspect the work area before commencement of work and completion of application
- Statutory official in charge of restricted/application zones
- Random polymeric health testing is conducted as per polymeric HMP

References

- Relevant SDS for Polyurethane Resin PUR (Strata Bond, Bevedan, Bevedol etc)
- Relevant SDS for Urea Silicate Resin USR (Mineral Bond, Geoflex)
- Recognised Standard 16 – The use and control of polymeric chemicals at underground mines (QLD).
- PTW
- GRO-5026-HMP-Use of Polymeric Chemicals

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- GRO -1486- RA- Use of Polymeric Chemicals for Strata Consolidation and Sealing
- GRO-9458-FRM-Polyurethane Resin (PUR) and Urea Silicate Resin (USR) Application Report
- GRO-8387-SWI-Collecting Urine Samples for Drug and Alcohol Testing and Health Monitoring
- GRO-8888-SWI-Unloading, Loading and Storing of Polymeric Chemical Deliveries
- Coal Mining Safety and Health Regulation 2017 (QLD)
- Work Health and Safety (Mines and Petroleum Sites) Act 2013
- Work Health and Safety (Mines and Petroleum Sites) Regulation 2014
- Hazard Chemicals Requiring Health Monitoring – Safe Work Australia 2013

TASK STEPS AND SPECIAL NOTES

WHEN USING THIS SWI, EACH STEP MUST BE CHECKED TO ENSURE IT IS APPROPRIATE FOR THE CONDITIONS PRESENT.

IF ANY CHANGE IS REQUIRED WHEN FOLLOWING THIS SWI, STOP WORK AND RISK ASSESS THE CHANGES.


ALL CHANGES MUST BE DOCUMENTED.

	TASK	PROCESS	IMPORTANT INFO
1.	Conduct SLAM	<ul style="list-style-type: none"> • Slam will be conducted between both pump and injection sites. • The following considerations shall be reviewed: <ul style="list-style-type: none"> ○ Visual checks of roof, ribs, floor, ventilation, gas and water. Make safe or report concerns to ERZ Controller. ○ Refer to conditions set out in Manager's Rules. ○ Check firefighting equipment is available. ○ Check first aid kit is available. ○ Always work under supported roof. ○ Check for adequate stone dust availability ○ ERZ Controller inspections. ○ Operators to be aware of the potential for loose under-footing underground. 	GRO – 1486 – RA – Use of Polymeric Chemicals PPE. <ul style="list-style-type: none"> • Splash proof goggles, • Viton or Nitrile gloves, • Coveralls (impervious if application is for long periods), • Type A organic respirator. • Barrier Cream AVOID SKIN CONTACT
2.	Permit PTW	<ul style="list-style-type: none"> • Review PTW 	
3.	Plan & prepare	In order for work crews to fully understand the injection task the following shall be available and understood. <ul style="list-style-type: none"> • Consolidation Plan • Permit to Work /Authorisation to Work is completed prior to commencing work. 	Note: When maintenance tasks are required to be performed and or where there is a potential for stored energy, positive isolation is required.

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		<ul style="list-style-type: none"> A pre-start meeting must be conducted on the surface or U/G in a safe place and recorded at the start of shift–this will outline the tasks and personnel involved in the task: Application of PUR and USR, review the SWI for the task Inspections of the equipment must be conducted prior to use. All equipment must be fully operational as per operator inspection sheet. <p>Inspections of the equipment must be conducted prior to use. All equipment must be fully operational as per operator inspection sheet.</p>	When equipment is required to be isolated, site isolation procedures are to be followed. IF UNSURE ASK YOUR SUPERVISOR
4.	Site Inspection / Job Assessment	<p>Task specific requirements for material, equipment and manning to be determined by carrying out a site inspection by, Ground Consolidation Representative, or as requested by Mine Official.</p> <p>Consult with Senior Mine Official on transport requirements for task, material pod and pump placement, site preparation work and requirements</p> <p>Supplied material requirements to be determined. (Packers, GRPs, Consumables)</p>	
5.	Transport & Supply	<p>Transport all equipment and consumables to site</p> <ul style="list-style-type: none"> All pods and equipment to be set up in designated areas as discussed between representative and Mine Official. All pods are to be transported utilising trained mine personnel. Chemical familiarisation and transportation training. Pods to be transported as per mine transport rules All Pods must be locked and fitted with product labels, spill kits and SDS's?? Ensure IBC's are loaded with the outlet valves facing the opening doors (IBC's must be positioned correctly in the pod). 	<p>PPE.</p> <ul style="list-style-type: none"> Splash proof goggles, Viton or Nitrile gloves, Coveralls (impervious if application is for long periods), Type A organic respirator. Barrier Cream <p>AVOIDSKIN CONTACT</p>
6.	Preparation work	Isolate, Lock/Tag Out and Test for Dead as required	
7.	Setup	<ol style="list-style-type: none"> Set up isolation Confirm Restricted Access Zone (RAZ) and Zone of Operation (ZOO) has been barricaded and signed. Authorised entry only. 	

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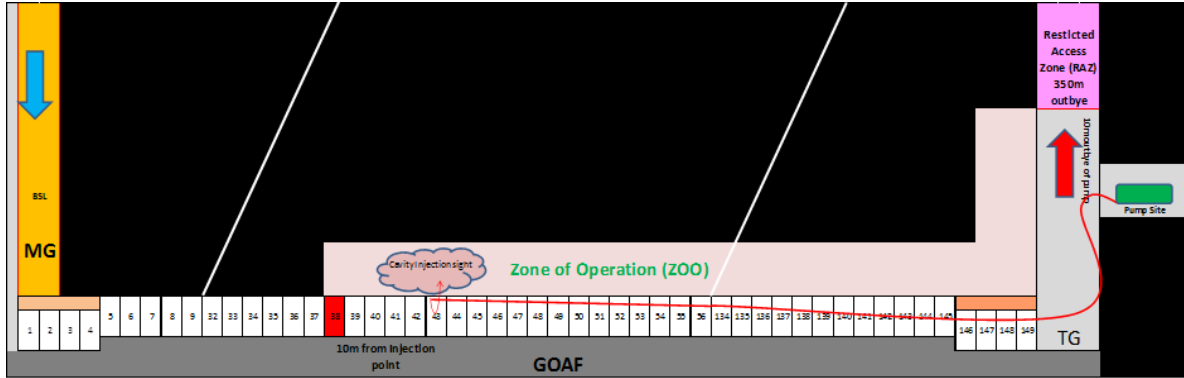
		<ul style="list-style-type: none"> A zone of operation shall be established prior to injection work commencing. The zone shall be marked by the erection of inbye and outbye perimeter barriers and signs.  <ul style="list-style-type: none"> The zone of operation shall be a restricted access area for all unauthorised persons. Access to the work site shall be under the control of the ERZ Controller. No person shall be permitted within the area 350m on the return side of the zone of operation (RAZ) while product components are pressurised. <p>The following process shall be carried out to ensure correct set up prior to injection, and will be referenced in the injection report check list:</p> <ul style="list-style-type: none"> All personnel are to notify ERZ controller when entering the district/zone. Isolate applicable machinery in accordance with control of energy SOP (GRO-241-SOP-Control of Energy) and Mark out the "ZOO" by use of no road tape and signage. Mark out Restricted Access Zone, this will be from the end of the ZOO to 350m return side of the ZOO. This is to be erected by the ERZ Controller. <p>NOTE: Only personnel who have completed the chemical familiarisation may enter the ZOO.</p> <p>No work other than pumping activities and inspections are to be conducted in the ZOO.</p> <p>MAINGATE set up (minimum requirements)</p> <ul style="list-style-type: none"> "ZOO" When pumping from the main gate, barrier (no road) tape and signage to be set 10m on the intake side of the pump as well as the belt road, and 10 m past the last injection. 	<ul style="list-style-type: none"> Splash proof goggles, Viton or Nitrile gloves, Coveralls (impervious if application is for long periods), Type A organic respirator. Barrier Cream <p>AVOID SKIN CONTACT</p>
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		<ul style="list-style-type: none"> • “RAZ” Barrier tape to be erected 10m on the outbye side of the furthest injection point and again at 350m on the return side this will establish the Restricted access zone. <p>TAILGATE set up (minimum requirements)</p> <ul style="list-style-type: none"> • “ZOO” When pumping from the Tailgate “ZOO” will be established from 10m intake side of the first injection point and 10m outbye of the pump / pods this will be marked by caution tape and tag. • “RAZ” No Road tape / tag 350m return side of pump / pods to establish “Restricted Access Area”. <p>NOTE: when supplies need to be delivered to the pump site in the TG, injection process must cease whilst the LHD is in the Restricted access zone.</p> <ol style="list-style-type: none"> 3. Test that an effective form of communication has been established e.g. DAC setup, light signals, verbal communication etc. 4. Confirm with the district ERZ controller that the minimum a ventilation requirement of 0.7 meters per second has been met 5. Ensure that strata conditions have not deteriorated prior to moving into the injection area. 6. Attach nozzle to injection feedpipe, hang nozzle and hoses out of the walk area so trip hazards are not created. 7. If injecting through TG cables, mega bots/strands, attach relevant fitting and screw into mixer tube to 3/8 hose connected to Y piece. 8. Check that all personnel within the zone of operation are accounted for and are authorised to be in the zone 	<ul style="list-style-type: none"> • Any equipment with the potential of damage due to exposure to the product must be covered with brattice • If the AFC cannot be run ensure coal is on the chain in the area of injection. • Feedpipe to be extended to ensure nozzle operator is located on pontoons out of the line of fire of potential strata failure.
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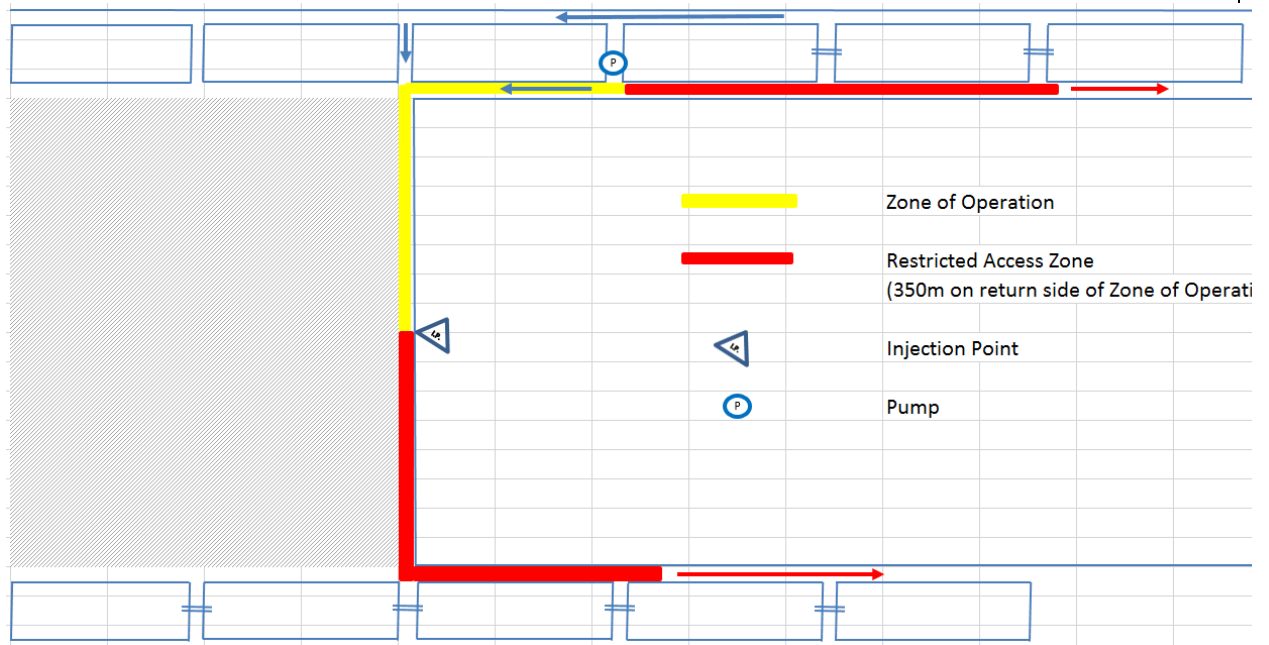
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8. Pumping from TG Side (seldom applied)

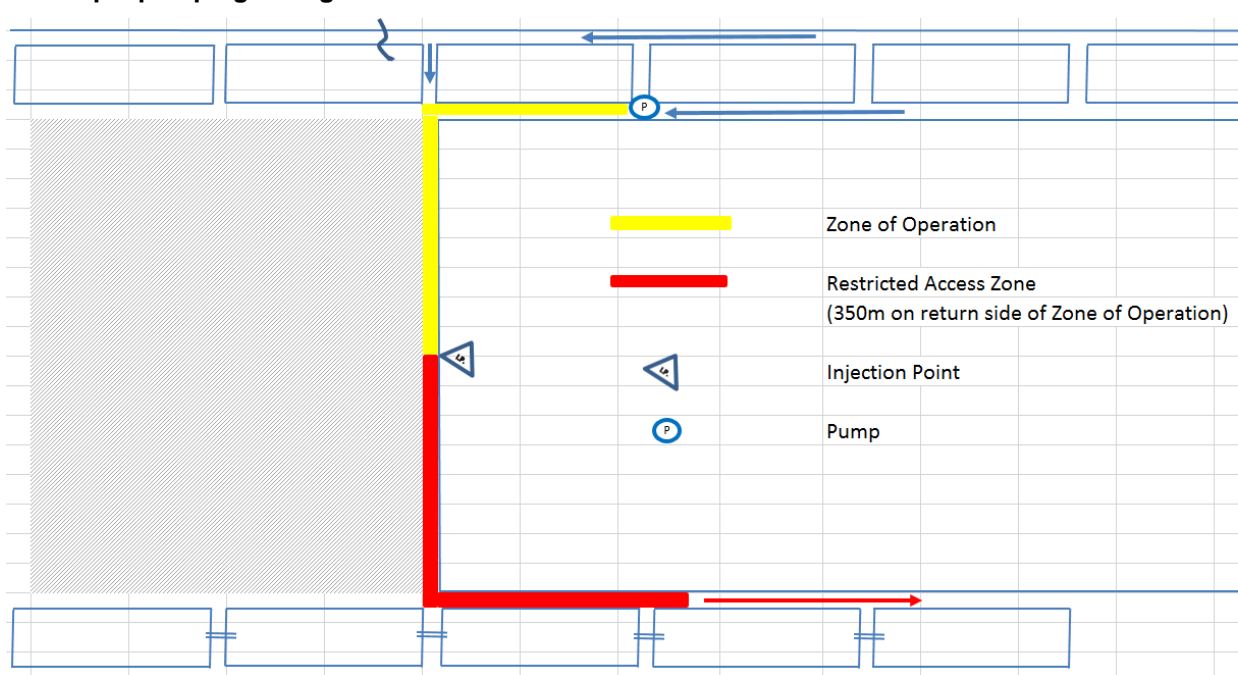


Pumping from MG Side

Homotropical pumping configuration



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Antitropical pumping configuration		
 <p>The diagram illustrates an antitropical pumping configuration. It shows a network of blue pipes with a central vertical section highlighted in yellow (Zone of Operation) and a horizontal section extending to the right highlighted in red (Restricted Access Zone). A pump (P) is located on the horizontal section. Arrows indicate the flow direction. A legend identifies the symbols: a yellow bar for Zone of Operation, a red bar for Restricted Access Zone (350m on return side of Zone of Operation), a blue triangle with a 'G' for Injection Point, and a blue circle with a 'P' for Pump.</p>		
9.	<p>Pump Product</p> <p>1.1 Commence Injection</p> <ol style="list-style-type: none"> Nozzle operator to communicate with pump operator to commence injection and open the control valves at the injection end of the operation. Once injection has begun the nozzle operator shall continuously monitor the pressure gauge to ensure pressure at the injection point does not exceed 80-85 bar or as per Geotechnical requirements. The nozzle operator will continuously monitor strata conditions and stop the injection if any of the following occurs: <ul style="list-style-type: none"> Quantity injected into a hole reaches 200kg (180Litres) for Polyurethane Resin (PUR) 400kg (300Litres) for Urea Silicate Resin (USR) Roof or Rib is showing excessive signs of movement. Excessive uncontrollable leaks. If pressure or litres reaches pre-determined limits as specified by mine. There are any signs of excessive heating. 	<p>PPE.</p> <ul style="list-style-type: none"> Splash proof goggles, Viton or Nitrile gloves, Coveralls (impervious if application is for long periods), Type A organic respirator. Barrier Cream <p>AVOIDSKIN CONTACT.</p> <ul style="list-style-type: none"> PUR will not be injected where a cement or grout has not had at least 24hrs to cure. Injection Resins must not be sprayed or used as a cavity fill. Do not stand under unsupported roof. Do not stand directly behind feed pipe

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		<p>4. The pump operator once the injection process has begun, shall continuously monitor pressure gauges at the pump ensuring that high pressures (the pump will recycle pressure back to tank in the event pressure reaches 200 bar) are reported to the nozzle operator. The pump operator is responsible for ensuring the product being pumped is within acceptable ratio limits (1:1). If the ratio is not correct the pump operator shall communicate with the nozzle operator and stop the injection process until the problem has been rectified. Viewing windows, measuring devices and or flow meters are to be used.</p>	<p>being injected, packer and consumables as they can be ejected from the hole under pressure.</p> <ul style="list-style-type: none"> Job rotation needs to be planned and occur during for the CMW allocated to run the drums to the pump Positive communication is require from the nozzle operator back to the pump operator in the event of any repair work or hose de-connection takes place at the nozzle to ensure the pump is off and pressure is released.
10.	Reporting	<p>GRO-9458-FRM-Polyurethane Resin (PUR) and Urea Silicate Resin (USR) Application report</p> <ul style="list-style-type: none"> All questions and tick boxes must be completed by Application supervisor as each section is completed. ERZ Controller to complete and sign required section in application report. Captured on Shift Report with Total KG pumped Application report sent to relevant Application and Anglo Departments (Longwall, Technical Services) Consumables used per hole, depth of hole and hole chainage/location. Litres injected per hole. 	<p>PPE.</p> <ul style="list-style-type: none"> Splash proof goggles, Viton or Nitrile gloves, Coveralls (impervious if application is for long periods), Type A organic respirator. Barrier Cream <p>AVOIDSKIN CONTACT</p>
11.	Clean Up Demobilization	<ol style="list-style-type: none"> Ensure ERZ Controller is aware injection process is complete and a 4hr fire watch is required. Also ensure ERZ Controller is aware that the clean-up process is an integral part of the injection process & must be completed as part of our procedure. Drain all residual product from suction lines back into the IBC's. AVOID SKIN CONTACT 	<p>PPE.</p> <ul style="list-style-type: none"> Splash proof goggles, Viton or Nitrile gloves, Coveralls (impervious if application is for long periods),

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	<ol style="list-style-type: none"> 4. ALL delivery hoses, injection hoses, recirculation hoses, pump and pump pressure relief valves are to be flushed with Hydraulic Oil for all PUR and USR products. No hose is to leave site without being flushed. 5. Roll up suction hose, all equipment is to be wiped clean and return to equipment/pump pods. 6. Reclaim all tools, feed pipes, packers, injection nozzle set up and equipment, return to pump/recovery pod. 7. Break each hose once flushed, rollup individually and place back into itself using the hose joiner and both staples to ensure hose is free from contaminants and will not allow for any leakage. Complete an information tag with your name, signature, date, time and a statement saying, "hose flushed with oil". 8. If hoses are to stay tied to back of pan line ensuring hoses are capped at both ends. 9. Account for all resin product IBC's make sure all pods are secured and locked ready for transportation. 10. Restock pump pod and recovery pod, wash down pump & hoses with mine pressure water/cleaning product, pod to be assembled ready for next Consolidation event. 11. Check pump and injection site for any exposed resin or spills, remove or cover with stone dust. 12. Re-check face for left over consumables. 13. Cut off where possible any protruding feed pipes. 14. Remove personal isolation locks/tags (all crew members). Notify ERZ Controller injection work is completed. 15. CMW's directly involved in the injection of PUR / USR will be subject to random <u>post shift</u> urine testing at a rate of one in five (20%). The injection crew supervisor or co-ordinator will use a marble bag to select CMW/s to be sampled. Urine Sampling is to be conducted according to GRO-8387-SWI - Collecting Urine Samples. 	<ul style="list-style-type: none"> • Type A organic respirator. • Barrier Cream <p>AVOID SKIN CONTACT</p>
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RESPONSIBILITIES:

- Ensure all activities conducted in their area of responsibility be undertaken in a manner consistent with the Application Contractor Safety, Health and Environment procedures.
- Familiar with requirements of the Grosvenor SHMS (core & critical procedures)
- Understand and implements Grosvenor requirements in relation to:

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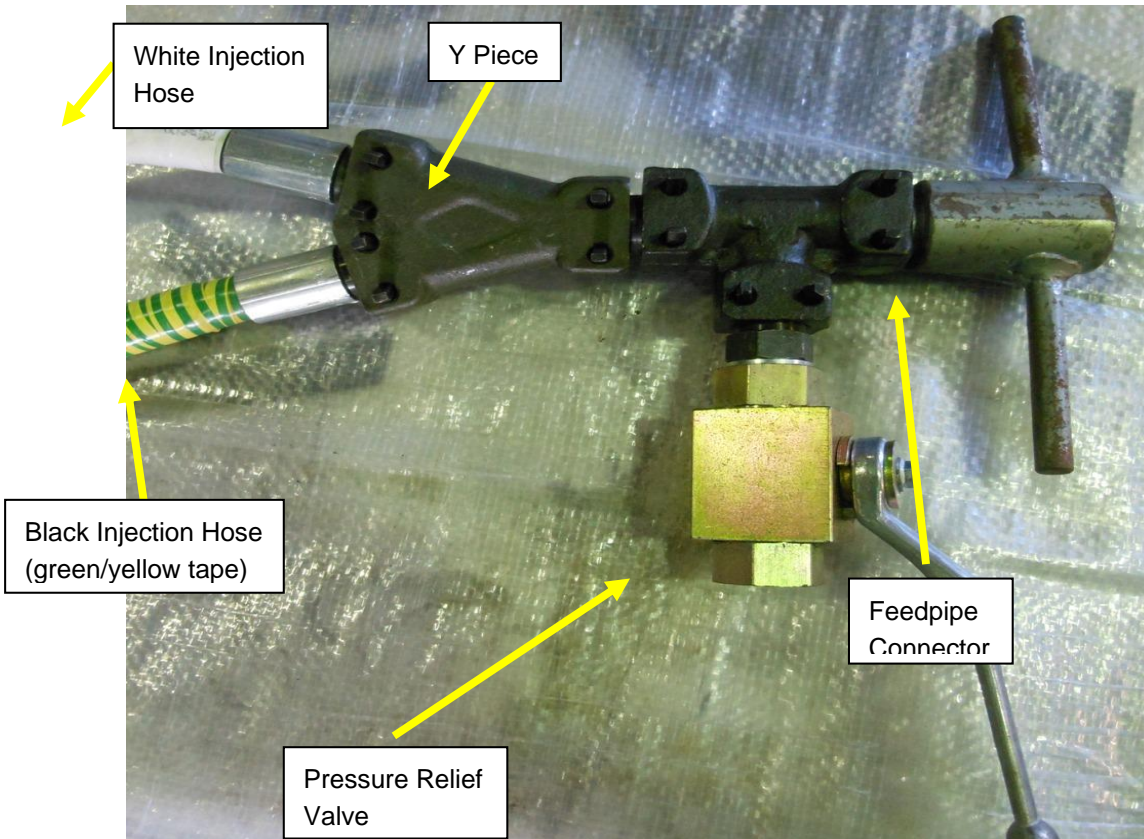
- ❖ Risk Management
- ❖ Fatigue Management
- ❖ Drugs and Alcohol in the Workplace
- Rigorous adherence to Company and Mine Site procedures
- Promotion of SH&E awareness and Injury prevention programs
- Awareness of the DSI\Techserve\Minova\ WMS Health Surveillance Plan and their obligations to participate in random Biological testing
- Adequate resources are available to undertake the task in a safe and efficient manner
- Daily responsibility and accountability for all employees under their direction,
- All Tasks under their direction are conducted in compliance with client and legislative requirements,
- The required authorisation / Permit to Work is in place to undertake the Task (Client, DSI\Techserve\Minova and/or WMS process)
- Must ensure that the personnel assigned to the task have had the required training to undertake the task in a safe and efficient manner.
- Current copies of the task PROCEDURE's, SDS's, Injection Report and current Licence is on the job site, available for employees to reference if required.
- Ensure all Mandatory Personal Protective Equipment is available, for all personnel for the required task.
- All incidents/accidents must be reported as soon as practicable to the Client and DSI\Techserve\Minova\WMS Management
- All incidents are to be investigated to prevent a reoccurrence. The level of the investigation will depend on the risk ranking of the incident.
- Will ensure that the equipment has the appropriate site introduction and approval
- The equipment is well maintained, regularly serviced and has the appropriate guarding and the appropriate safety features

NOTE: When the PROCEDURE for the Task does not identify or manage all hazards/risks associated with the Task - A JSEA is to be conducted prior to any work commencing to manage risk exposures.

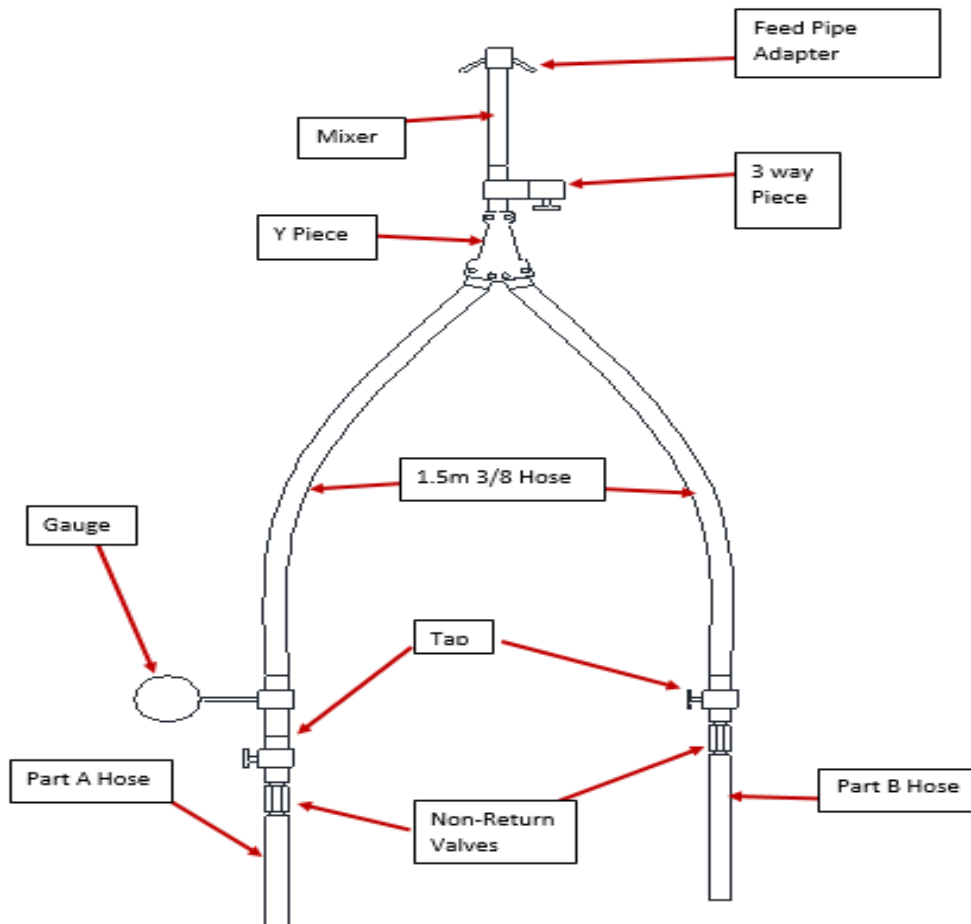
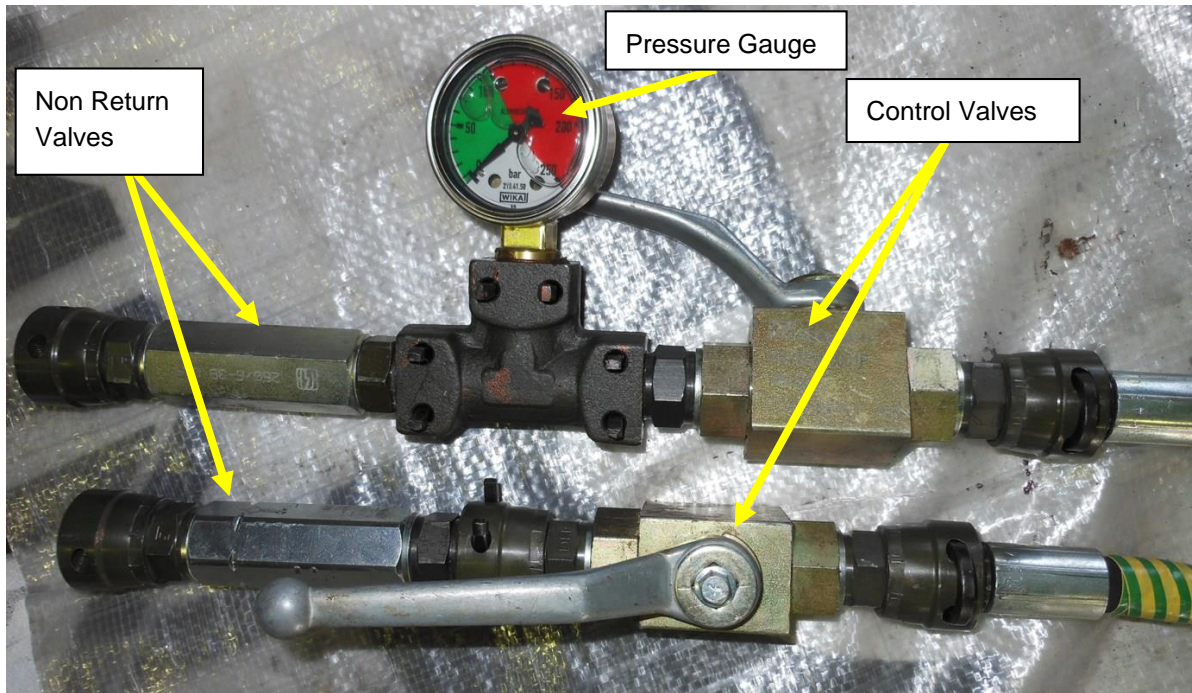
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Appendix A

Resin Injection Nozzle/Gun Assembly



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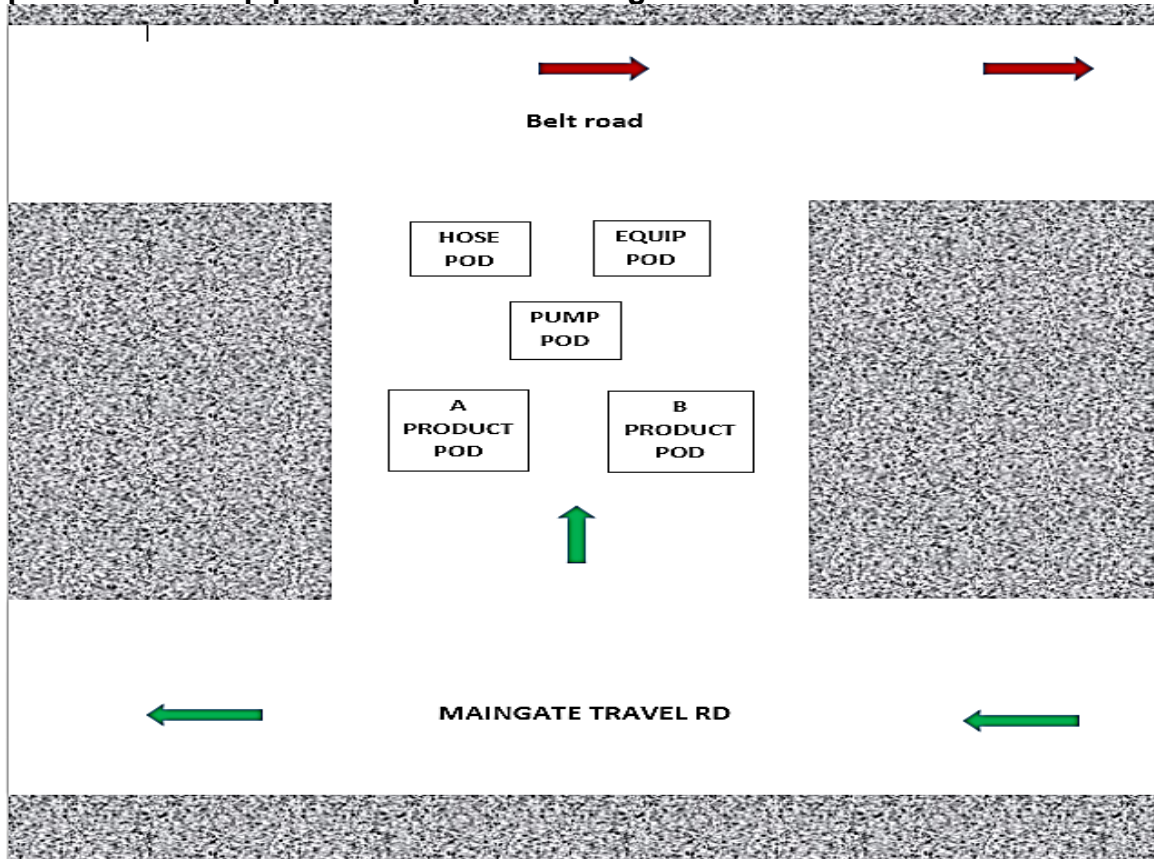


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Appendix B – Correct loading IBC's into Pods



Appendix C – Pump pod set up in Cut Through



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Appendix D – Product Calculation Chart

UREA SILICATE RESIN INJECTION CALCULATION TABLE						
IBC MEASUREMENT (MM)	USR A		USR B		TOTAL KG	TOTAL LITRES
	LITRES	1.48 KG	LITRES	1.12 KG		
9	10	14.8	10	11.2	26	20
18	20	29.6	20	22.4	52	40
27	30	44.4	30	33.6	78	60
36	40	59.2	40	44.8	104	80
45	50	74	50	56	130	100
54	60	88.8	60	67.2	156	120
63	70	103.6	70	78.4	182	140
72	80	118.4	80	89.6	208	160
81	90	133.2	90	100.8	234	180
90	100	148	100	112	260	200
99	110	162.8	110	123.2	286	220
108	120	177.6	120	134.4	312	240
117	130	192.4	130	145.6	338	260
126	140	207.2	140	156.8	364	280
135	150	222	150	168	390	300
139	153	226.4	153	171.4	398	306
POLYURETHANE RESIN INJECTION CALCULATION TABLE						
IBC MEASUREMENT (MM)	PUR A		PUR B		TOTAL KG	TOTAL LITRES
	LITRES	1.02 KG	LITRES	1.21 KG		
9	10	10.2	10	12.1	22.3	20
18	20	20.4	20	24.2	44.6	40
27	30	30.6	30	36.3	66.9	60
36	40	40.8	40	48.4	89.2	80
45	50	51	50	60.5	112	100
54	60	61.2	60	72.6	134	120
63	70	71.4	70	84.7	156	140
72	80	81.6	80	96.8	178	160
81	90	91	90	108.9	200	180

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