



THE DTI ANCHOR LOCK-OFF SYSTEM

38T MECHANICAL ANCHOR

(Grouted installation)



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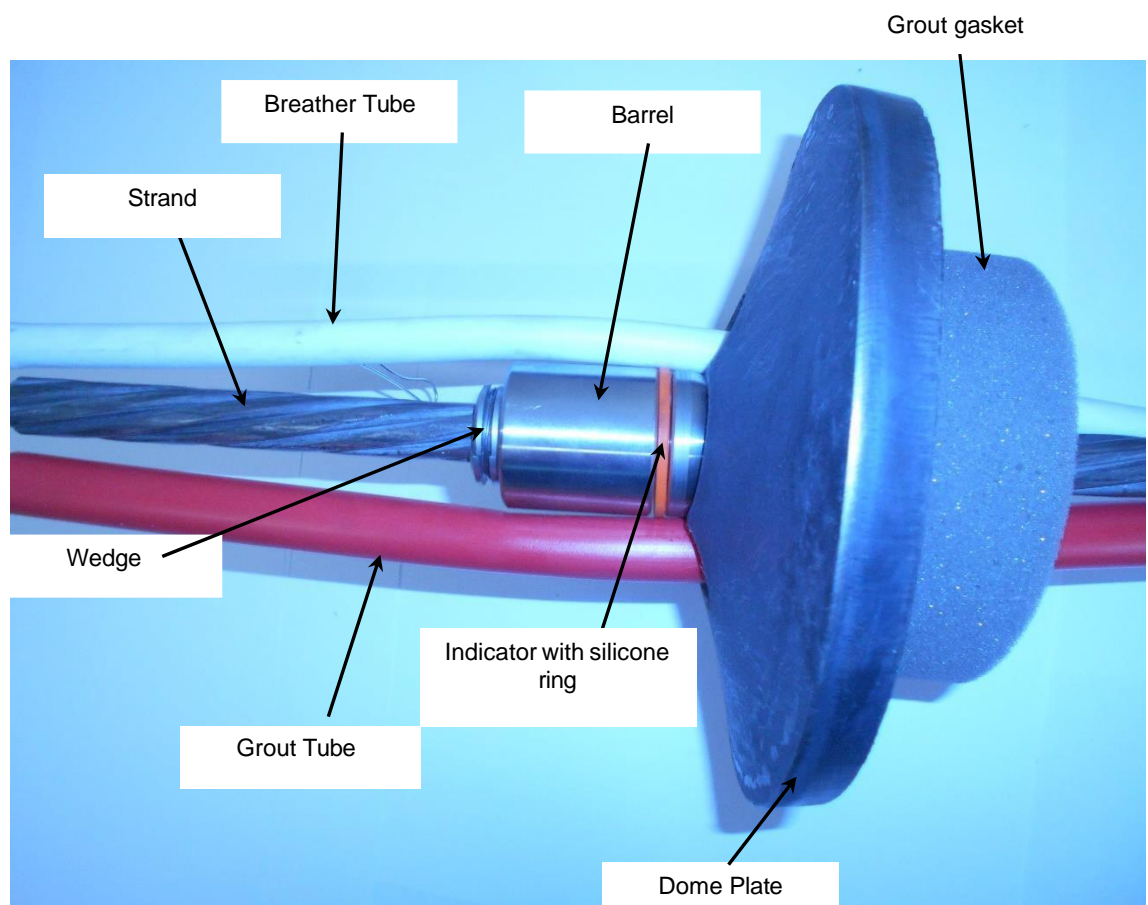
Introduction

UG MINING 's latest innovation in anchor lock off technology is the DTI system. The system consists of a dome plate, an integral aligning member, an indicator, barrel and wedge

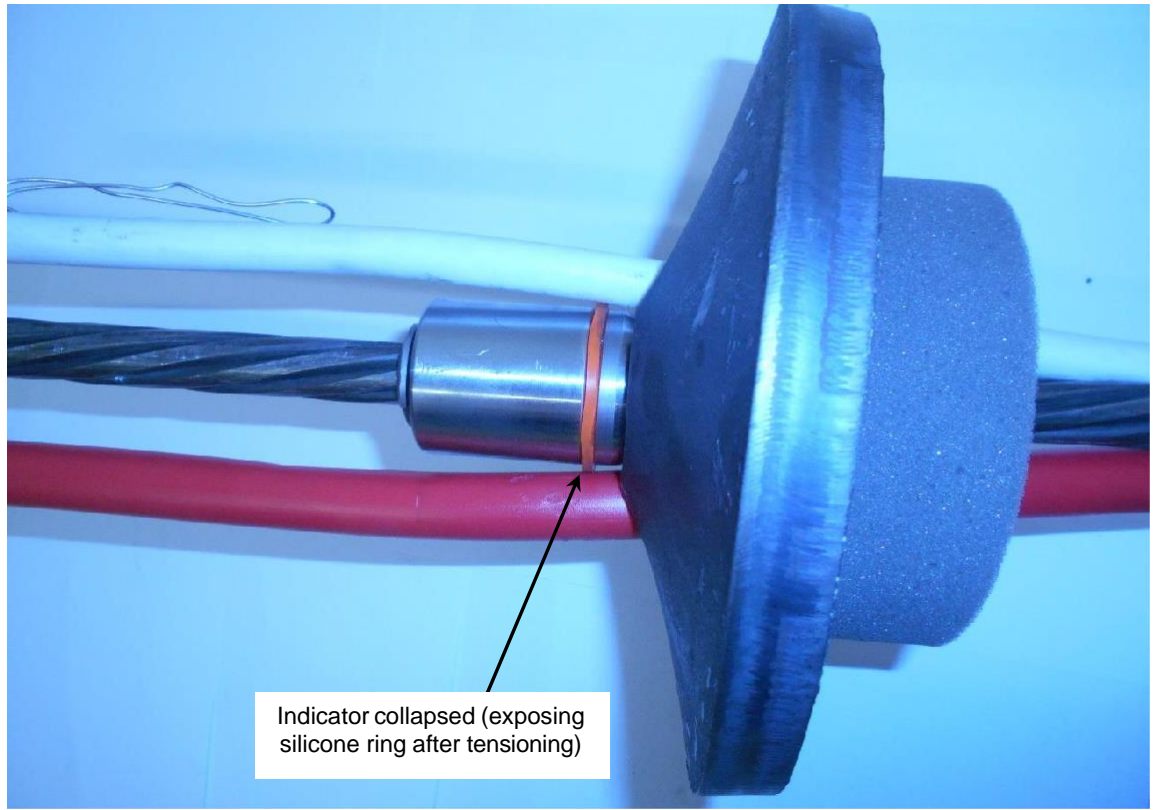
Key features and benefits of the DTI system

- ❖ Ease of grouting
- ❖ Anti-pre-activation device
- ❖ Positive lock-off (rigid placement of the wedge and compression of the barre)
- ❖ Visual load indicating device, the bright silicone ring

DTI Lock-Off System in section (pre-tension)



DTI Lock-Off System in section (post-tension)



**STANDARD OPERATING PROCEDURE FOR THE INSTALLATION OF A
DTI MECHANICAL CABLE ANCHOR**

1 Purpose

To ensure that the DTI mechanical anchor is installed in a correct and safe manner.

2 Scope

UG MINING DTI mechanical anchor installation for underground strata support (hanging wall, side wall and footwall support)

3 Definitions

Underground strata support – support installed to prevent a fall of ground, or, a pressure burst of either the sidewall or footwall.

4 Responsibilities

A responsible person must be put in place to ensure that all stressing equipment and drilling equipment required for the installation of the anchors is available and in good working order. This person should also ensure that the anchor and all its components, including any cement / grouts are available if required.

5 Procedure

STEP	ACTIVITY	RESPONSIBILITY
1.	<p><u>Instructions & Preparation</u></p> <p>Receive instructions clearly defining (authorising) the location, type of anchor and the quantity of anchors to be installed.</p> <p>Ensure that the correct materials are used for installation- i.e. anchors, cement / grout.</p> <p>Ensure that all of the required machinery and equipment is available to perform the installations and that they are in good working order. Recommended air pressure 6 to 7 Bar.</p> <p>Compressed air or hydraulic power pack is available to power the stressing equipment.</p> <p>Ensure that the correct stressing equipment is available and in good order. Stressing pump, stressing jack (with DTI nose cone) and cropper.</p>	<p>Section Manager/ Contract Manager</p>

	<p>Hydraulic hoses are not leaking.</p> <p>Ensure that temporary support is in place before starting with the installations. The area must be declared safe by the responsible person appointed for that area.</p>	
2.	<p><u>De-coiling the anchor (if required)</u></p> <p>If the anchor is coiled it will need to be de-coiled for use. An anchor is made from high strength, high carbon steel that has tremendous spring energy when coiled. Lay the anchor flat on the ground and inform personnel around you that you are going to de-coil the anchor. Standing on the anchor with it lying flat on the ground cut the wire binding so that the leg of the anchor will kick out AWAY from you. Exercise great caution when de-coiling anchors.</p>	Team Leader
3.	<p><u>Checking & Preparing the Drilled Hole</u></p> <p>Ensure that the hole is flushed with air/water to remove dust and loose particles.</p> <p>Insert the anchor upside down into the hole to determine whether the hole is clear of obstacles and is the correct depth (approx. 500mm of the anchor must protrude out of the hole). After checking remove the anchor from the hole.</p> <p>If the anchor has been pre-assembled keep one unassembled strand to check the hole depth.</p> <p>(Also check that the correct diameter hole has been drilled.)</p>	Operator
4.	<p><u>Preparing the Cable Anchor</u></p> <p><u>If anchor is not fully assembled</u> - Place the gasket over the strand then the dome plate; guide the breather tube through a slot on the dome plate and push the grout tube into the other side of the slot; then place the barrel followed by the wedge over the strand up against the dome plate. Push the assembly firmly into position.</p> <p><u>If the anchor is fully assembled</u> (as is requested from time to time) then the gasket, dome plate, barrel and wedge would be fitted onto the strand.</p>	Operator Assistant
5.	<p><u>Installing & Tensioning</u></p> <p>Only persons directly related to installing the anchors should be in the immediate vicinity. All safety apparel should be worn, including most importantly, safety glasses, hard hats and gloves</p>	Team Leader

<p>6.</p>	<p><u>Cropping the Cable Anchor</u></p> <p>Crop the anchor by fitting the cropper over the strand and activating the pump. Crop +/- 150mm from the barrel. N.B. ensure that the cropper operating procedure is adhered to at all times).</p> <p>Ensure that cropped pieces of PC strand are safely removed as they have very sharp edges and can cause injury.</p> <p>For safety it is strongly recommended that a spare barrel and wedge is placed over the strand below the cropper during cropping. This will prevent any of the short strand ends from becoming dangerous projectiles. Remember the shorter the piece to be cropped the higher the risk that one or more short strands could shoot out during cropping.</p>	<p>Operator</p> <p>Operator</p> <p>Operator Assistant</p>
<p>7.</p>	<p><u>Grouting</u></p> <p>A good quality grout must be used and be mixed thoroughly to a homogenous consistency.</p> <p>Mix the grout thoroughly to the grout manufacturer's specification, using a good quality mixer (not by hand with a stick). Connect the grout pump from the grout mixer and place over the grout tube. Before pumping blow into the anchor breather tube to ensure it is not blocked or pinched closed.</p> <p>It is a norm that grout will settle in the hole. With this in mind, pump until it is obvious that grout, and not only water, is bleeding from the breather tube.</p> <p><u>Note</u> It is of prime importance that the grout manufacturer's directions for use and specifications are adhered to. Once grout starts pumping from the hole on the breather tube, the hole is fully grouted.</p> <p>When you are sure that it is a grout bleeding from the breather, bend the breather tube over and tie off with the pull wire. Continue pumping for a few strokes, thus pressurising the hole.</p> <p>Bend over the grout tube and tie off with a piece of wire or cable tie. The installation is now complete.</p>	<p>Operator</p>

RISK ASSESSMENT FOR THE:

MANUFACTURE, SUPPLY AND USE OF THE 38T

DTI MECHANICAL CABLE ANCHORS

1. Methodology

A risk assessment generally involves identifying the potential hazards, which could lead to injury to persons or property loss, and giving them a risk rating. Suitable controls are then put in place to reduce the risk to one which is acceptable in terms of the relevant sections of the mines Health and Safety Act and Occupational Health and Safety Act.

NOTE: In terms of the Mines Health and Safety act, a manufacturer is regarded as any person or organisation which designs, manufactures, imports, sells or supplies any article for use at work. Legislation requires that articles used at work must be safe and without risk to the safety and health of the user when properly used.

- A **HAZARD** is something that has the potential to cause **HARM**. This includes substances, machines, and methods of work or other aspects of the work organisation.
- **SEVERITY** is a figure attached to the amount of damage or harm that could be incurred should an incident take place.
- **PROBABILITY** is the likelihood that harm from a particular hazard will occur;
- **RISK RANKING** is the product of **SEVERITY** and **PROBABILITY**.
- The extent of the risk depends not only on the severity of the harm to a person that may occur but also on the number of people who may be involved or the extent of property damage or financial loss.

The intention is to see where failure may take place and then assessing the severity in terms of the degree of harm or damage, which may occur. This will include the extent of exposure to the risk.

2. Risk Measurement and Risk Matrix

The risk team (Table 4) made use of the 5 point risk matrix (Table 1) as tabulated below. The probability and severity of each item / job was evaluated in terms of the likely hood of an event taking place and should such an event take place, the possible consequences. (Tables 2 and 3). This is a standard system which has been previously used in the industry and has been recognized by international authorities.

Risk Matrix

		Probability				
		1	2	3	4	5
Severity	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

Table. 1

Probability of an Event Taking Place		
1	Practically Impossible	Un-likely (25 years)
2	Not Likely	10 Years
3	Could Happen	Annually
4	Has Happened	Monthly / Quarterly
5	Common	Daily / Weekly or more often.

Table. 2

Consequence / Severity Should the Event take Place		
	People Related	Financial Implications
1	No Injury or Lost Time	High Potential with Little to No cost
2	Lost Time Injury	R50,000
3	Reportable Injury / Disability	R50,000, Less Than R1m
4	Permanent Disability / Fatal	R1m to R5m
5	Multiple Fatality	>R5m

Table. 3

3. Risk Assessment Team

TEAM MEMBER	COMPANY	QUALIFICATION TO QUALITY CIRCLE
Jaco Pretorius	Technical Sales Manager	Mechanical Engineer
Thabiso Makhaza	Production Manager	Competent A &B
Lucas Ndinisa	Technical Sales Rep.and demonstrator	Competent A &B

MANUFACTURING, QUALITY ASSURANCE, HANDLING, STORAGE, LOADING, TRANSPORT & USE											
Task / Process / Activity	Potential Hazard	Possible Consequences	Existing Controls	P	C	R.R.	Additional Controls	P	C	R.R.	Responsible Person
Manufacturing the Anchors	Anchors not manufactured to specification	Support failure F.O.G. Multiple fatalities Serious Injuries to persons Damage to equipment and infrastructure Production loss	ISO9000 quality management system (<i>Anchor Manufacturing production Job Card work instruction LOGM_WI017</i>) Batch control of all critical input components from suppliers Batch control	2	5	10					Production Supervisor

MANUFACTURING, QUALITY ASSURANCE, HANDLING, STORAGE, LOADING, TRANSPORT & USE											
Task / Process / Activity	Potential Hazard	Possible Consequences	Existing Controls	P	C	R.R.	Additional Controls	P	C	R.R.	Responsible Person
Packaging	Anchor are not packed completely (missing accessories)	Short supply Commercial loss	ISO9000 quality management system (<i>Anchor Manufacturing production Job Card work instruction LOGM_WI017</i>) Packaging procedure in place	3	2	6					Production Supervisor

	Anchors are not strapped together properly	Damage to anchor components (plastic pipes) Short supply Commercial loss	ISO9000 quality management system (<i>Anchor Manufacturing production Job Card work instruction LOGM_WI017</i>) Packaging procedure in place	3	2	6					Production Supervisor

MANUFACTURING, QUALITY ASSURANCE, HANDLING, STORAGE, LOADING, TRANSPORT & USE											
Task / Process / Activity	Potential Hazard	Possible Consequences	Existing Controls	P	C	R.R.	Additional Controls	P	C	R.R.	Responsible Person
Storage at manufacturer	Anchors are not stored correctly	Damage to anchors and or components go missing Commercial loss	Storage procedure in place Anchors to be stored in demarcated area's	3	2	6					Production Supervisor
	Anchors exposed to adverse weather conditions	Corrosion of metal components; deterioration of plastic components Commercial loss	Anchors to be stored under waterproof covering.	2	2	4					Production Supervisor

MANUFACTURING, QUALITY ASSURANCE, HANDLING, STORAGE, LOADING, TRANSPORT & USE											
Task / Process / Activity	Potential Hazard	Possible Consequences	Existing Controls	P	C	R.R.	Additional Controls	P	C	R.R.	Responsible Person
Loading for transportation to mine	The anchors are loaded incorrectly. Un-even or off balance.	Damage to anchors Financial loss Short supply Damage to equipment and infrastructure	Competent trained personnel operating loading equipment Loading procedure in place	2	2	4					Production Supervisor
	Load not securely fastened	Load can fall during transport Damages to load Shortage of supply Damage to equipment and infrastructure Damage to 3 rd party vehicles Road accidents Serious injuries Fatalities		1	4	4					Production Supervisor

MANUFACTURING, QUALITY ASSURANCE, HANDLING, STORAGE, LOADING, TRANSPORT & USE											
Task / Process / Activity	Potential Hazard	Possible Consequences	Existing Controls	P	C	R.R.	Additional Controls	P	C	R.R.	Responsible Person
Transporting material to the store	Company driver not familiar with Client Stores and offloading procedures	Time Delays Deliveries in-completed. – Financial loss. Client dissatisfaction Serious injuries to person Damage to equipment and infrastructure. (People not fully aware of site safety rules and regulations)	Adhere to all rules and regulations. Complete necessary induction.	2	3	6					Production Supervisor
Handling the anchors in the stores	Sharp steel edges	Lacerations and piercing injuries	Mines working procedures and instructions. Correct use of P.P.E. including gloves & safety goggles.	3	2	6					Client Store Supervisor
	Heavy lifting	Back injuries	Mines working procedures and instructions.	3	2	6					Client Store Supervisor

MANUFACTURING, QUALITY ASSURANCE, HANDLING, STORAGE, LOADING, TRANSPORT & USE											
Task / Process / Activity	Potential Hazard	Possible Consequences	Existing Controls	P	C	R.R.	Additional Controls	P	C	R.R.	Responsible Person
Installing the cable anchor	Sharp steel edges	Minor cuts / bruises Serious injury to person	Mines working procedures and instructions including COP's Correct use of P.P.E.	3	2	6					Client
	Mechanical anchor slips when being tensioned	Production delays Serious injury to person F.O.G. Fatalities Multiple fatalities Damage to equipment Financial loss	Check that the correct size hole has been drilled Check that the correct size shell has been supplied as ordered. Determine if the ground conditions are too bad for mechanical head to lock-off. Follow suppliers installation SOP's Mines working procedures and instructions including COP's	3	5	15	Inspection of ground conditions by trained professionals (Rock Engineers) Annual training of installation teams (COP's, SOP's, hazards and risks etc.)	2	5	10	Client

<p>Installing the cable anchor</p>	<p>Mechanical anchor does not fit into the drilled hole</p>	<p>Production delays</p>	<p>Check that the correct size hole has been drilled</p> <p>Check that the correct size shell has been supplied as ordered.</p> <p>Mines working procedures and instructions including COP's</p> <p>Follow suppliers installation SOP's</p>	<p>3</p>	<p>1</p>	<p>3</p>	<p>Annual training of installation teams (COP's, SOP's, hazards and risks etc.)</p>				<p>Client</p>
<p>Installing the cable anchor</p>	<p>Anchor not tensioned to the desired load (under tensioned)</p>	<p>Anchor does not lock-off properly and slips</p> <p>Production delays</p> <p>F.O.G.</p> <p>Serious injury to person</p> <p>Fatalities</p> <p>Multiple fatalities</p> <p>Damage to equipment</p>	<p>Mine to inspect quality of installations and tension indicating devices</p> <p>Mines working procedures and instructions including COP's</p> <p>Follow suppliers installation SOP's</p>	<p>3</p>	<p>5</p>	<p>15</p>	<p>Annual training of installation teams (COP's, SOP's, hazards and risks etc.)</p>	<p>2</p>	<p>5</p>	<p>10</p>	<p>Client</p>

		Financial loss									
	Mechanical anchor over tensioned	Anchor breaks Damage to roof / strata F.O.G. Serious injury to person Fatalities Multiple fatalities Damage to equipment Financial loss	Mines working procedures and instructions including COP's Follow suppliers installation SOP's	2	5	10	Annual training of installation teams (COP's, SOP's, hazards and risks etc.)	2	5	10	Client
	Debris falling from roof	Eye irritation, damage to eyes Minor cuts / bruises Serious injury to person	Mines working procedures and instructions including COP's <u>Never enter an area under unsupported roof</u> Correct use of P.P.E.	3	2	6					Client

Installing the cable anchor	F.O.G.	Minor cuts / bruises Serious injury to person Fatalities Multiple fatalities Damage to equipment Financial loss	Mines working procedures and instructions including COP's <u>Never enter an area under unsupported roof</u> Correct use of P.P.E.	3	5	15	Inspection of ground conditions by trained professionals (Rock Engineers) Annual training of installation teams (COP's, hazards and risks etc.)	2	5	10	Client
	Mobile Machinery	Vehicle colliding with installation personnel Minor cuts / bruises Serious injury to person Fatalities Multiple fatalities Damage to equipment Financial loss	Mine's working procedures and instructions including COP's <u>Never enter an area under unsupported roof</u>	2	5	10					Client
Installing the cable anchor	Working at heights	Minor cuts / bruises	Mine's working procedures and instructions including	3	4	12					Client

		<p>Serious injury to person</p> <p>Fatalities</p> <p>Damage to equipment</p> <p>Financial loss</p>	<p>COP's</p> <p><u>Never enter an area under unsupported roof</u></p> <p>Correct use of P.P.E.</p> <p>Mines procedures for working at heights. Use of safety belts etc.</p>						
	Heavy lifting	<p>Back injury</p> <p>Minor cuts / bruises</p> <p>Serious injury to person</p>	<p>Mine's working procedures and instructions including COP's</p> <p><u>Never enter an area under unsupported roof</u></p> <p>Correct use of P.P.E.</p> <p>Mines procedures for working at heights. Use of safety belts etc.</p>						Client
Installing the cable anchor	Pneumatic / Hydraulic anchor installation equipment	<p>Pipes dislodging and causing injury</p> <p>Hydraulic pipes failing under high pressure causing oil</p>	<p>Make use of safety slings</p> <p>Check the condition of equipment especially pipes before each use. Do not use equipment that appears to be faulty, defective or</p>	2	4				Client

		injection injuries (serious, potentially fatal injury)	incomplete								
		Serious injury to person	Follow the equipment manufacturers guide for safe operation and maintenance								
		Fatalities	<u>Never enter an area under unsupported roof</u>								
		Damage to equipment	Correct use of P.P.E.								
		Financial loss									

MANUFACTURING, QUALITY ASSURANCE, HANDLING, STORAGE, LOADING, TRANSPORT & USE											
Task / Process / Activity	Potential Hazard	Possible Consequences	Existing Controls	P	C	R.R.	Additional Controls	P	C	R.R.	Responsible Person
Storage of Anchors	Anchors are not stored correctly	Damage to anchors and or components go missing	On surface, anchors to be stored undercover.								
		Support failure F.O.G. Multiple fatalities Serious Injuries to persons	Anchors to be issued last in, first out to reduce time that the anchors are exposed to surface elements	3	2	6	Mines supervisory controls. Inspections etc	2	2	4	Client
		Damage to equipment and infrastructure									
		Production loss									



**CSIR Implementation Unit
Mechanical Testing**

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Cottesloe 2092 Johannesburg

CERTIFICATE OF TEST

**Test on five strands complete with barrel,
dome washer and wedge (38 t)**

Application Received: 04 August 2017

Certificate No.: T25452

Order No.: POA62640

Date of test: 07 August 2017

SUBMITTED TO

Mr Jaco Pretorius
Fabchem Mining (Pty) Ltd
P O Box 1253
SPRINGS
1560

1. INTRODUCTION

At the request of Mr Jaco Pretorius of Fabchem Mining (Pty) Ltd, five strands complete with barrel, dome washer and wedge (38 t) were submitted for tensile testing to destruction. The test was conducted according to the customer's request.

2. TEST PROCEDURE

Testing machine: 1 000 kN Amsler Universal testing machine
Test type: Destruction in tension
Test specification: Customer's request

The strands were in turn installed in the 1 000 kN Amsler Universal testing machine using suitable fittings as shown in Figure 1. A gradually increasing tensile load was applied to the specimen until failure occurred.

Notice:
ONLY the original signed report must be
regarded as the official document.

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Testing Officer: 
JAN KGANYAGO
Engineer: 
RUTH TELEKA



Figure 1. Strands complete with barrel, dome washer and wedge (38 t) installed in the testing machine



3. TEST RESULTS

The results of the destruction tests carried out on the strands complete with barrel, dome washer and wedge (38 t) are summarised in Table 1.

Table 1. Test results for the strands complete with barrel, dome washer and wedge (38 t)

Test No.	Maximum load carried (kN)	Test Comment
1	359	The failure modes are as shown in Figure 2.
2	343	
3	350	
4	345	
5	348	
Average	349	
Standard deviation	6.2	

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Testing Officer: 
JAN KGANYAGO
Engineer: 
RUTH TELEKA

Certificate #: T25452

Date Issued: 15 August 2017

DMS Ref: COT Gen:21636.1

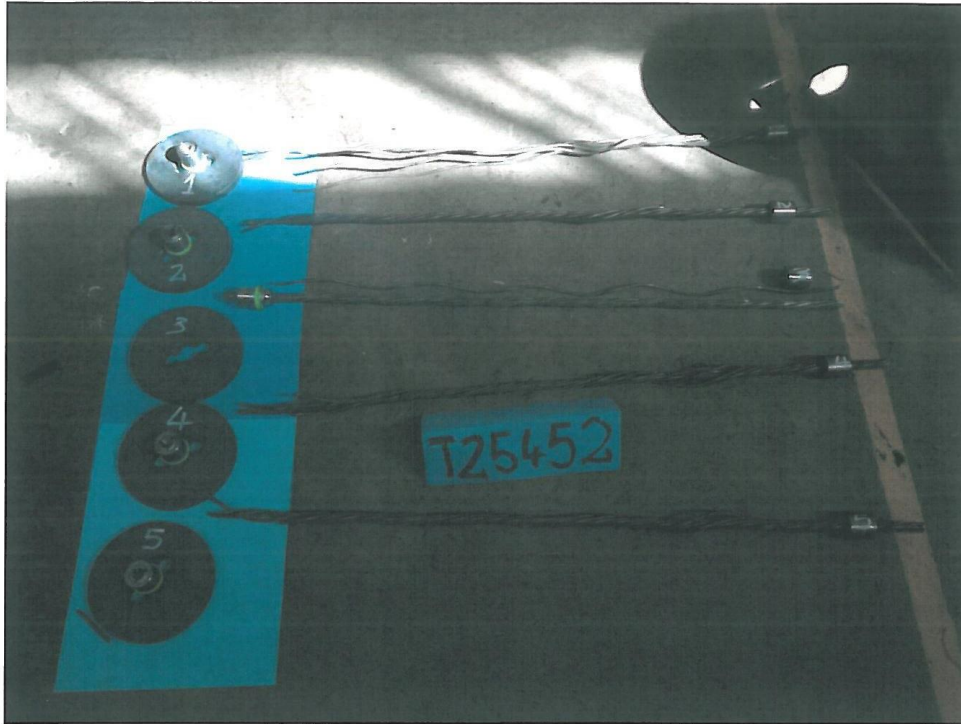




Figure 2. Specimens after the test

4. DISCLAIMER

1. The CSIR cannot be held responsible for product indifferences and cannot be held responsible for any accidents or incidents as a result thereof.
2. Due to the limited amount of sample(s) tested and the type of testing done, CSIR can only account for the results from those specific samples tested.
3. All CSIR Routine Testing General Contract Conditions and conditions of testing apply.
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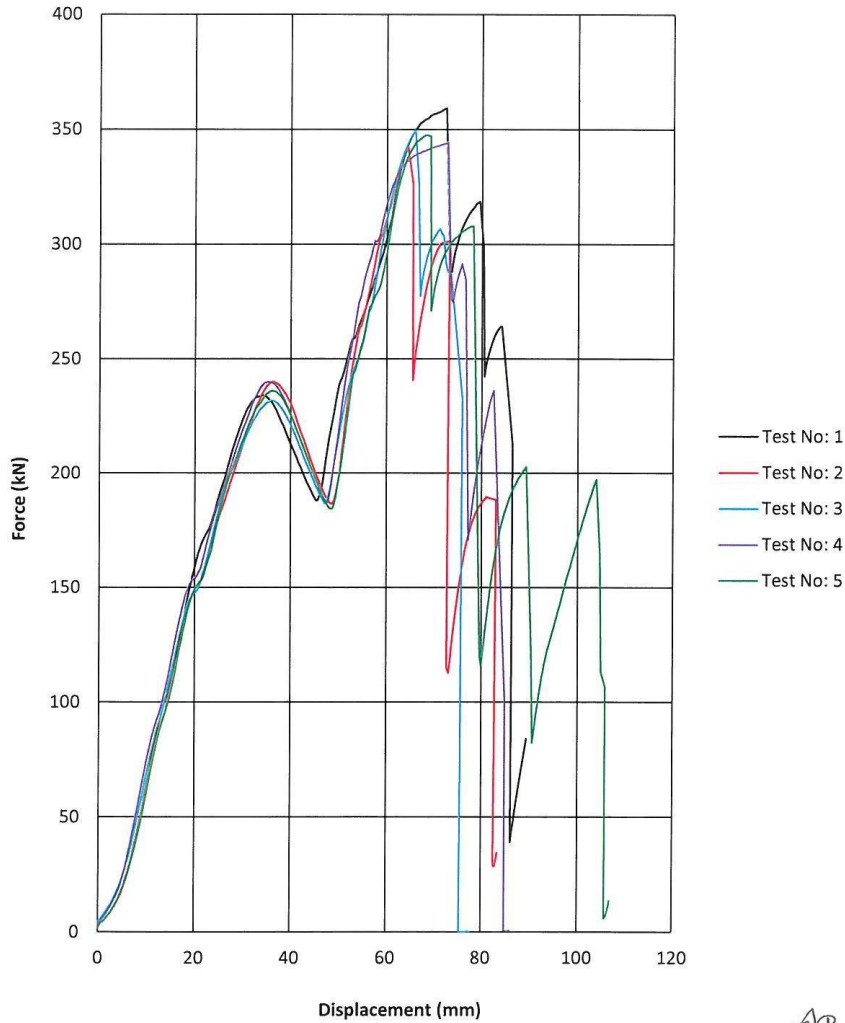
Date Issued: 15 August 2017

DMS Ref: COT Gen:21636.1





Certificate No.: T25452
Date of test: 07 August 2017
Applicant: Fabchem Mining (Pty) Ltd
Description: Strands complete with barrel, dome washer and wedge (38 t)

Test No:	1	2	3	4	5
Maximum force (kN):	359	343	350	345	348



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Engineer: 
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