MIDWEST ROCKFALL, LLC

SUBMITTAL

ROCK ANCHOR

Vermont Agency of Transportation

RECEIVED

Highgate STP0297(8) Wire Mesh Approved 8-21-2013.pdf

CK'D BY _____ OK'D BY CB

August 19, 2013

RESUBMIT NO Approved

BY KH DATE 8-21-2013

Submittal 900.620

Rock Anchor Testing

Submittal 900.640

Rock Anchor

Paragraph 29.a Qualifications

MIDWEST ROCKFALL, INC. **EMPLOYEE NAME RESUME**	Project Name: HighGate STP	Employee Name: Luke Fetzer
	Project No: 0297(8)	Item No:
	Item Name: Wire Mesh/Rock Anchor	Date: 6/17/2013

RESUME NARRATIVE

Luke Fetzer has a extensive background in rockfall mitigation. Just with Midwest Rockfall he has Accumulated over 1800 hrs of rock scaling, over 7,500 lf of rock drilling, 72,000 sf of shotcrete, has helped install over 2 million sf of rockfall mesh, 450,000 sf of cable net, and has been a part of installing almost 4 miles of various rockfall fences.

PROJECT EXPERIENCE & REFERENCES

DATE	PROJECT NAME	OWNER	CONTACT INFORMATION	WORK DESCRIPTION
Sep-2007	Tricon Engineering Exploratory Drilling	NCDOT	Tri-Con Engineering 336-668-0093 Boone, NC	350LF Exploratory Drilling
Sep-2007	CDOT Rockfall Fence Testing	CDOT	Ty Ortiz 303-589-0573 4210 E. Arkansas Ave. Denver,CO	30 crew hrs scaling 95,000 sf cable net 800 lf rockbolts 4,750 shotcrete
Mar-2009	PENNDOT Rockfall Fence Relocation	PENNDOT	Jarred Musser 412-462-9300 Po Box 98100 Pittsburgh, PA	1,100 lf of Rockfall fence
Oct-2007	SH 67 Rockfall Mitigation	PW Construction	Melissa Levison 843-388-2027 Cripple Creek, CO	404 crew hrs scaling 30 mesh anchors 18,000 sf wire mesh
Oct-2007	Summit County Scaling Green Mountain	Summit County Public Works	John Polhemus 970-668-4231 PO Box 626 Frisco, CO 80401	200 Crew hrs scaling
Feb-2008	Hanging Lake Tunnel Extensometer Install	CDOT	Ty Ortiz 303-589-0573 4210 E. Arkansas Ave. Denver,CO	high angle install of 16 extensometers
Feb-2008	Miner's Mesa Rock Stabilization	City of Blackhawk	Jim Ford 303-582-2237 Black Hawk, CO	70,000 sf wire mesh 400 crew hrs scaling 60 mesh anchors
May-2008	Paonia Rockfall Fence	Private Homeowner	Brandon Glimpse 970-234-1485 31136 Lazear Rd. Hotchkiss, CO	500 lf rockfall fence
Sep-2009	Guanella Pass	Central Federal Lands Hwy. Div.	Tony Swedin 720-284-7868 7353 S. Eagle St. Centennial, CO	400 lf rockfall fence 330 crew hrs scaling 1,100 lf dowels 80,000 cable net/ wire mesh
Aug-2010	Moran Junction Slope Remediation	WYDOT	Muareen Larson 406-233-3220 Po Box 400 Miles City, MT 59301	18,000 sf wire mesh 30 crew hrs scaling
Apr-2009	ITD Landslide	ITD	Andy Erquigua 208-465-4778 16200 N. 20th St. Nampa , ID	1,000 lf rockfall fence
Oct-2008	Summit County Scaling Dillon Dam	Summit County Public Works	John Polhemus 970-668-4231 PO Box 626 Frisco, CO 80401	200 Crew hrs scaling
Oct-2008	Dowd Junction	CDOT	Ben Arnt 303-781-9590 420 Seventh St. Glenwood Springs	80,000 sf wire mesh 110 mesh anchors
Mar-2011	Mine Adit Closure	City of Blackhawk	Jim Ford 303-582-2237 Black Hawk, CO	2,500 sf shotcrete
Nov-2011	Hyampom Road	Western Federal Lands Hwy. Div.	Steve Manning 530-222-0810 Po Box 491660	375 crew hrs scaling 180,000 sf wire mesh 300 mesh anchors
Feb-2009	Boulder Canyon Trail	Boulder Parks & Recreation	Renee Edick 303-678-6235 9595 Nelson Rd Longmont, CO	30 crew hrs scaling 14,000 sf wire mesh 30 mesh anchors
Apr-2009	US-12 West Side White Pass	WASDOT	Robert Fleming 509-930-0221 Yakima, WA	3,000 lf rock bolts 90,000 sf wire mesh 450 crew hrs of scaling 4,500 sf shotcrete

PROJECT EXPERIENCE & REFERENCES

DATE	PROJECT NAME	OWNER	CONTACT INFORMATION	WORK DESCRIPTION
Sep-2009	Trail Ridge Road	Central Federal Lands Hwy. Div.	Dennis Black 970-627-5467 Lakewood, CO	1,200 lf of historic guardwall remediation
Oct-2009	Hartford-Newbury Rockfall Mitigation	VADOT	Tom Eliassen 802-828-6916 One National Life Dr. Montpelier, VT	400 lf hybrid rockfall fence 500 crew hrs scaling 2,800 lf of rock dowels
Feb-2010	Christensted Bypass	Central Federal Lands Hwy. Div.	Better Roads Asphalt PO Box 21420 San Juan, PR 00928	45,000 sf cable net 200 crew hrs scaling 55 mesh anchors
Jun-2010	City of Georgetown Rockfall Fence	City of Georgetown	Fischer Construction 303-485-8855 7460 Weld County Rd. 1 Longmont, CO	550 lf rockfall fence
Jan-2010	Xcel Energy Road Drainage	Xcel Energy	Ken Elliott 303-571-7503 1800 Larimer St. Suite 400 Denver, CO	900 lf of high angle ditch paving high angle culvert and pipe install
Aug-2011	I-70 Rockfall Mitigation	CDOT	Jim Van Dyne 303-324-8408 4210 E. Arkansas Ave. Denver, CO	50 crew hrs scaling 102,000 sf wire mesh 14,000 sf cable net 120 lf fence 2,200 lf anchors
Apr-2010	Cabin Creek Landslide	Central Federal Lands Hwy. Div.	Kumar & Associates 303-742-9700 2390 S Lipan St. Denver, CO	install of temporary rockfall barrier install of slope monitoring system
Jul-2010	Norwood Hill Rockfall Mitigation	CDOT	Tom Allen 970-384-1442 3803 N. Main Ave. 200 Durango, CO	85,000 sf cable net 15,000 sf wire mesh 900 lf of rock bolts 450 crew hrs scaling
Jul-2010	BNSF Railroad Derailment	BNSF	Neil McCulloch 400 N 34th St.suite 100 Seattle, WA	75 crew hrs of scaling 2,300 of rock bolts 6,000 sf of shotcrete
Jul-2010	Beartooth Highway	Central Federal Lands Hwy. Div.	Grant Johns 4901 S.Windermere St. Littleton , CO	3,000 sf of veneer stone facing
Aug-2010	US-285 Rockfall Mitigation	CDOT	Brannan Sand & Gravel 2500 Brannan way Denver, CO	350 crew hrs of scaling 45,000 sf of cable net 35 cable anchors
Sep-2010	I-91 Rock Stabilization	Winterset Construction	Jason Waysville PO Box 968 Lyndonville, VT 05851	400 crew hrs scaling 2,100 lf rock dowels
Oct-2009	Summit County Scaling Green Mountain	Summit County Public Works	John Polhemus 970-668-4231 PO Box 626 Frisco, CO 80401	300 crew hrs scaling
Oct-2010	Seven Falls Rock stabilization	Harrison Western Construction	Steve Johnson 720-206-4499	55,000 sf cable net 75 mesh anchors Various high angle light replacement
Jan-2011	Walmart Slope Remediation	McCrory Construction	Bill Osbourne 803-799-8100 1280 Assembly St. Columbia, SC 29201	365,000 sf cable net 100 crew hrs scaling 900 lf of rockfall fence
Sep-2011	Moran Junction Rockfall Mitigation	Oftedal Construction	Muareen Larson 406-233-3220 Po Box 400 Miles City, MT 59301	200 crew hrs of scaling 180,000 sf wire mesh 200 mesh anchors
Dec-2010	Manilla Creek Road	WASDOT	Brandi Coliyer 509-324-6242 Spokane ,WA	300 crew hrs of scaling 2,200 lf rockbolts 55,000 sf wire mesh
May-2011	I-70 Rockfall Mitigation	I-70 Rockfall Mitigation	Jim Van Dyne 303-324-8408 4210 E. Arkansas Ave. Denver, CO	1,300 lf rockfall fence 65,000 cable net 200 crew hrs of scaling 11,000 sf ring net
Aug-2011	Dix Dam Rockfall Mitigation	Kentucky Utilities	Dave Beck 859-748-4424 815 Dix Dam Rd. Harrodsburg KY	85,000 sf cable net 900 lf rockfall fence 100 crew hrs scaling 2000 lf rock dowels

Submittal 900.620

Rock Anchor Testing

Submittal 900.640

Rock Anchor

Paragraph 29.b,1

Work Plan Proposed Rope Access Methods

MIDWEST ROCKFALL, INC. **WORK PLAN**	Project No.: 0297(8)	Item Description: Rock Anchor
	Project Name: HighGate STP	Item No:
	Location: HighGate , VT	Quantity / Units 350LF
	Prepared By: Luke Fetzer	Date: 6/17/2013

Work Description	WORK PLANS
Rope Access Method	Workers will access the slope using the SPRAT method. Safety plan attached seperately
Rock Anchor Type and Calibration Data	Williams Form Engineering catalog cuts and Calabration Data attached seperatley
Mill Certification	Avalable when Material is dellivered to the project site
Rock Anchor Installation	Rock anchors will be installed using a Marini drill slide and a 4" Atlas Copco DTH. Once the hole is flushed clean of any debris workers will insert the anchor with centralizers and tremmie tube attached assuring the hole is free from obstructions. Next workers will attach the grout hose and begin grouting Type 1 Type 2 portland with a Chemgrout pressurized grout pump until hole is full and then fill the "birds beak" after initial grout has cured. During the erection of the gabion wall workers will attach couplings and threadbar to pertrude through the gabions and then attaching the bearing plates, nuts, and washers and then torquing the nuts to the required load

Work Description	Labor Type	QTY	Units	Units / Day	Total Days	Hours / Day	Days / Week	Reg. Hrs	O.T. Hrs	Total Hours
Rock Anchoring	Driller	LF	350	100	3.5	10	3.5	35	0	35
									TOTAL WORKING DAYS	4

Work Description	Equipment	QTY	Rental Period	Standby Hrs	Operating Hrs
Anchor Installation	Mini Excavator	1	0	10	40
Anchor Installation	375 CFM air compressor/ Marini Drill Slide	1	0	10	40
			0		

Quantity	Units	Material Description	ASTM / AASHTO
350	LF		Material Data Sheets Attached
		Grout	Separately
		Threaded Bar and Accessories	

Description	Reference	Quality Assurance	Additional Attachments
		Field Tested Anchors	
		Certificates of Conformance	

MWR FORM 505

SAFE PRACTICES FOR ROPE ACCESS WORK

SPRAT®

Society of Professional Rope Access Technicians

Society of Professional Rope Access Technicians
994 Old Eagle School Road, Suite 1019
Wayne, PA 19087-1866
www.sprat.org

SAFE PRACTICES FOR ROPE ACCESS WORK

1. Scope, Purpose, Application, Exceptions, and Interpretations
2. Definitions
3. Requirements for Safe Work Practices
4. Duties and Responsibilities of the Employer
5. Duties and Responsibilities of the Rope Access Program Administrator
6. Duties and Responsibilities of the Level III Technician (Rope Access Supervisor)
7. Duties and Responsibilities of the Level II Technician (Rope Access Lead Technician)
8. Duties of the Level I Technician (Rope Access Worker)
9. Section Held for Authorized Worker
10. Rope Access Equipment
11. Access and Hazard Zones
12. Communication Systems
13. Use of Suspended Work Platforms in Conjunction with Rope Access
14. Tools and Work Equipment
15. Rescue and Emergency Services

Appendix

1 SCOPE, PURPOSE, APPLICATION, EXCEPTIONS, AND INTERPRETATIONS

1.1 Scope

This document sets forth accepted practices for rope access work performed using non-metallic synthetic ropes. This document does not apply to emergency response or emergency response training, except as provided in Section 15.

1.2 Purpose

The purpose of this document is to provide information and guidance on acceptable practices and procedures to protect employees from the hazards associated with rope access work methods when working at height. This document is written for all persons concerned with rope access work and especially for those primarily responsible for establishing and administering rope access work methods. This document contains requirements recommended for use by enforcement authorities in establishing regulations or codes on rope access work methods.

1.3 Exceptions

Regulatory agencies may have requirements that are different from this standard.

1.4 Interpretations

Request for interpretations of this standard shall be in writing and addressed to the Secretariat of this standard.

© 2012 Society of Professional Rope Access Technicians

2 DEFINITIONS

2.1 ***Access work plan:** A written statement prepared by the employer describing how a particular job (or types of jobs where these will be essentially identical) should be undertaken to ensure any risks to health and safety of the workers, or others who may be affected, are minimized or eliminated.

2.2 **Access zone:** The area in which people are at risk of falling such as on-rope or near a working edge. This area requires protective measures such as verbal warnings, signs, barriers, safety lines, or other devices designed to prevent or arrest a fall.

2.3 **Aid climbing:** A method of vertical movement on a fixed line or lateral movement in which the climber moves from one anchor to another closely placed anchor.

2.4 **Anchor, anchorage:** A place, fixing or fixture that supports and to which the various ropes and rope systems are attached.

2.4.1 **Anchor, main:** Main anchors are located at the top of and provide the primary support for the life-safety system.

2.4.2 ***Anchor, deviation:** Deviation anchors change the direction of the rope system. In common practice, the rope does not connect to a deviation anchor, but runs through a carabiner or connector.

2.4.3 **Anchor, rebelay:** A rebelay is a type of anchor located below the main anchor and used to direct the rope away from the fall line. The rope connects to a rebelay anchor.

2.4.4 **Anchor, load sharing:** Several anchors connected together to make a single anchor that meets the strength required for rope access work.

2.5 **Approved equipment:** Equipment deemed appropriate for use with rope access techniques. Approved equipment shall meet the specifications set forth herein, or other specifications set forth in the access work plan, if more stringent.

2.6 ***Ascender:** A type of rope grab that is used primarily for climbing a rope by gripping the rope when loaded in one direction and sliding freely in the opposite direction.

2.7 **Belay:** An active system operated by another employee for the purpose of arresting the fall of a rope access worker.

2.8 **Carabiner:** A type of connector, formed as a complete loop with a spring-loaded entry gate.

2.9 ***Carabiner, locking:** A carabiner with a mechanism that reduces the possibility of a gate being opened inadvertently.

2.9.1 **Carabiner, two-stage locking:** A locking mechanism that requires at least two different consecutive manual actions to open the gate.

2.9.2 **Carabiner, three-stage locking:** A locking mechanism that requires at least three different consecutive manual actions to open the gate.

2.9.3 ***Carabiner, self-locking:** A gate that locks automatically when it closes.

2.10 ***Descender:** A device that acts as a brake on a rope.

2.11 **Dynamic rope:** A rope that is specifically designed to absorb the energy of a fall by extending in length thereby minimizing the shock load to the worker, rope system, and anchors.

2.12 **Employer:** A corporation, partnership, proprietorship, government agency, or other organization that authorizes its employees to perform rope access work.

2.13 **Fall arrest:** Equipment, system, or structure that arrests the fall of a worker.

2.14 **Fall factor:** The maximum distance a person could fall, divided by the length of the rope attaching the person to the anchorage point.

2.15 **Fall prevention:** Equipment, system, or structure that prevents a fall from occurring.

2.16 ***Hazard zone:** Any area where a person may be at risk as a result of the work being performed.

2.17 ***Job safety analysis**: A component of the Access Work Plan which indentifies hazards, the hazard mitigation methods and outlines requirements to promptly rescue the rope access worker.

2.18 **Kernmantle rope:** A rope consisting of an internal load-bearing core enclosed within a separate braided sheath.

2.19 **Low stretch rope:** Rope that has an elongation of 6% to 10% at 10% of minimum breaking strength. See also Static Rope.

2.20 **Main line:** The primary rope used for descending, ascending or positioning.

2.21 **Minimum breaking strength:** Manufacturer's rating used by the employer to calculate safe working loads.

2.22 **On-rope:** The condition of being suspended from or attached to a rope.

2.23 **Proof load:** A test load applied to verify that an item of equipment will not exhibit permanent deformation under that load, at that particular time.

2.24 **Rescuer:** A person performing a rescue other than the rescue subject of the rescue.

2.25 **Rescue service:** Organization determined by the employer to be capable of safe and effective rescue of rope access workers.

2.26 **Retrieval:** Procedure for rescuing rope access workers without placing a rescuer on-rope.

2.27 ***Retrieval system:** The equipment (including a retrieval line, harness, lifting device, and anchor) used for rescue of rope access workers without placing a rescuer on-rope. The safety line may be used as the retrieval line in a retrieval system.

2.28 ***Rope access:** A means of access by descending or ascending a main line while the worker is protected by a safety line. Rope access also includes the use of climbing and aid climbing techniques with fall protection.

2.29 **Rope access program administrator:** A person authorized by their employer to be responsible for managing the employer's rope access program, who is suitably knowledgeable, experienced, and qualified to manage the rope access program, including matters relating to safety, training, regulations, staffing, equipment selection and management, and other program responsibilities as designated by the employer.

2.30 **Rope access technician:** A person who has completed a rope access certification program and has the appropriate training and experience to perform the duties required according to the assigned level of responsibility. There are three levels of Rope Access Technician.

2.30.1 **Level III Technician (rope access supervisor):** A person with the training, skills, experience and certfication necessary to assume responsibility for the entire rope access work site, including management and guidance of other Rope Access Technicians on the worksite, who is capable of designing, analyzing, evaluating and specifying rope access systems, and who has the knowledge and experience to direct rescue operations from rope access systems, as well as the skills necessary to perform advanced rescue from rope access systems.

2.30.2 **Level II Technician (rope access lead technician):** A person with the appropriate training, skills, experience, and certification to perform, under the direction of a Rope Access Supervisor, all rope access rigging, work and, at a minimum, has the skills necessary to perform standard rescue from rope access systems.

2.30.3 **Level I Technician (rope access worker):** A person with the appropriate training, skills, and certification for performing, under the direct supervision of a Rope Access Lead Technician or Supervisor, standard rope access operations and, at a minimum, has the skills necessary to perform limited rescue from rope access systems.

2.31 **Rope grab:** A device used to grasp a life safety rope for the purpose of supporting a load.

2.32 **Safe working load (SWL):** The designated maximum force that may be placed on an item of equipment as calculated by the employer from the minimum breaking strength.

2.33 **Safe zone:** Any area outside the Hazard Zone or the Access Zone.

2.34 **Safety, secondary, belay or backup rope:** Rope used to protect against falls if the user slips or the primary support, anchor or positioning mechanism fails.

2.35 **Safety factor:** The minimum strength of the system divided by the maximum anticipated load expressed as a ratio.

2.36 **Shall:** The word "shall" is to be understood as denoting a mandatory requirement.

2.37 **Should:** The word "should" is to be understood as denoting a recommendation.

2.38 **Static rope:** Rope that has an elongation of 6% or less at 10% of minimum breaking strength. See also Low Stretch Rope.

3 REQUIREMENTS FOR SAFE WORK PRACTICES

3.1 A Rope Access Program Administrator shall be the main contact point for matters relating to the safety, training and regulatory aspects of rope access. The designated person shall be suitably knowledgeable and experienced in rope access techniques.

3.2 Rope access work practices shall include the ability for self-rescue or prompt rescue by other rope access workers. All work plans shall include the necessary information for contacting the local emergency services.

3.3 *A Rope Access Work Plan shall be completed before beginning rope access work. The Rope Access Work Plan shall include, but not be limited to, the following objectives.

3.3.1 List the rope access systems to be used for the proposed work.

3.3.2 *List the members of the work team by name and identify their duties.

3.3.3 List the rope access equipment to be used for the work to be performed.

3.3.4 List the hazards associated with the work to be performed and actions to be taken to mitigate the hazards.

3.3.5 List appropriate personal protective equipment (PPE) to be used.

3.3.6 List provisions for providing security to the anchor location.

3.3.7 List public safety provisions.

3.3.8 Describe the accident response plan and list the outside rescue service and the procedure for contacting

3.4 *Before starting work, the Rope Access Supervisor shall complete a Job Safety Analysis. In particular, attention shall be given to the following aspects.

3.4.1 Ability of the suspended person to safely use materials, equipment or tools necessary for the work and whether the reaction from any equipment or tool may place the person at risk.

3.4.2 Whether the work may loosen material which could become a hazard to the worker or others.

3.4.3 Whether the time required for the work at any one location will be such that there may be unacceptable levels of risk.

3.4.4 Whether it would be possible to quickly rescue workers that are using rope access techniques from any position they could be expected to enter.

3.5 *The Rope Access Supervisor shall ensure that anchors have been evaluated in order to ensure that overall system safety is adequate.

3.6 Each rope access worker shall use a fall arrest system meeting the fall protection regulations or standards of the jurisdiction or country of the work; such as ANSI/ASSE, CSA or EN/CE.

3.6.1 *Safety, Secondary or Backup line(s) or other appropriate belay devices shall be used in addition to the main line unless the employer can demonstrate that the second line or other belay devices would create a greater hazard or otherwise would not be feasible.

3.6.2 The safety line used for fall arrest should have its own separate anchor and should be separately fixed to the worker's harness. This does not preclude both lines being attached to a single harness attachment point.

4 DUTIES AND RESPONSIBILITY OF THE EMPLOYER

4.1 The employer shall develop and implement a policy statement that provides general goals and guidance for a rope access program that emphasizes management's commitment to providing a safe workplace for personnel engaged in rope access work.

4.2 The employer shall provide the resources that are necessary for the development, implementation and operation of their rope access program.

4.3 The employer shall appoint a Rope Access Program Administrator who meets the requirements of this standard, and who has the authority to manage and direct the employer's rope access program.

4.4 The employer shall develop and maintain written rope access and rescue procedures for every location where its employees use rope access.

4.5 The employer shall ensure that employees are informed of foreseeable hazards that they may encounter during the performance of their duties.

4.6 The employer shall ensure that all employees have the knowledge and training necessary to safely perform the rope access work to which they are assigned.

4.7 The employer shall ensure that all personnel assigned to supervise or otherwise manage other personnel on the worksite are capable in terms of knowledge, training and experience to provide such oversight.

4.8 *Employee selection and capabilities

4.8.1 The employer shall verify prior rope access training and/or experience.

4.8.2 Employer shall determine that personnel are sufficiently physically capable and free from any impairment that may prevent them from working safely. Employees should have a medical examination before employment in rope access work and at regular intervals.

4.8.3 The employer shall use certified Level I Technicians (Rope Access Workers) who have the appropriate training for the assigned tasks and/or Level II Technicians (Rope Access Lead Technicians) or a Level III Technician (Rope Access Supervisor) to conduct all work on-rope.

© 2012 Society of Professional Rope Access Technicians

4.8.4 The employer shall use a Level II Technician (Rope Access Lead Technician) or a Level III Technician (Rope Access Supervisor) for system setup and system safety checks.

4.8.5 The employer shall provide for periodic re-assessment, recurrency training, and re-certification of the employer's Rope Access Technicians.

5 DUTIES AND RESPONSIBILITIES OF THE ROPE ACCESS PROGRAM ADMINISTRATOR

5.1 *A Rope Access Program Administrator is responsible for the development, implementation, monitoring, review, and revision of the employer's rope access program, and has overall responsibility for the program.

5.2 The Rope Access Program Administrator shall:

5.2.1 Recognize the limitations of its personnel (in terms of training, qualifications, experience, and expertise) to perform rope access work, and ensure that no work is undertaken that exceeds those limitations.

5.2.2 Have a working knowledge of current applicable federal, state and local regulations that apply to rope access and working at height, directly or indirectly, and ensure implementation of all such requirements.

5.2.3 Establish and implement procedures for ensuring and verifying that all employees have the necessary training, skills, and experience for each rope access project to which they are assigned, according to their duties and responsibilities as outlined in this standard.

5.2.4 Establish and implement procedures for ensuring that all hazards to which employees may potentially be exposed on a rope access project are identified, and controlled or eliminated, prior to the commencement of the rope access project.

5.2.5 *Ensure that all rope access projects are appropriately supervised.

5.2.6 Ensure that the procurement, inspection, tracking, and replacement of equipment used for rope access projects is performed by a person (or persons) with the appropriate knowledge, training and experience to perform the assigned task as it relates to the Rope Access Employer's operations.

5.2.7 Ensure communication and coordination with clients and their safety representatives regarding rope access safety and rescue procedures.

5.2.8 Provide, or verify that personnel are provided with all appropriate rope access, rescue and personal protective equipment for each rope access project.

5.2.9 Ensure that procedures are in place for establishing and marking work zones, and for keeping other personnel and the public out of affected work areas.

5.2.10 Ensure that procedures are consistent with all applicable regulatory requirements and standards related to the work environment, and that such requirements are followed by all employees.

5.2.11 Establish and implement procedures for ensuring that all required planning and documentation, including work permits, job safety analyses, and rescue plans are completed prior to the commencement of rope access projects, and that all affected personnel are appropriately briefed.

5.2.12 Verify that rope access personnel maintain all necessary training and certifications.

5.2.13 Ensure that employee rope access and training hours are recorded properly.

5.2.14 Provide, or verify provision of, all employee training required to meet the provisions of this standard and of the employer's rope access program.

5.2.15 Participate in the investigation of all incidents related to injuries or near misses involving employees during rope access work or training, either personally or through a qualified individual designated to investigate the incident(s), and taking necessary corrective action to eliminate the causes of such incidents.

5.2.16 Perform any other duties and responsibilities that are necessary for the development, implementation, and maintenance of a safe and effective rope access program, given the particular nature of the employer's operations and the environment in which rope access work is to be performed.

6 DUTIES AND RESPONSIBILITIES OF THE LEVEL III TECHNICIAN (ROPE ACCESS SUPERVISOR)

6.1 A Rope Access Supervisor shall have overall responsibility for the rope access work site and the rope access personnel assigned to that work site.

6.2 To the extent that other qualified personnel are assigned a duty or responsibility that is also designated as a duty or responsibility of the Rope Access Supervisor, the Rope Access Supervisor shall retain primary responsibility to ensure and/or verify that the assigned task is accomplished.

6.3 Where appropriate, the Rope Access Supervisor may also perform duties and responsibilities of the Rope Access Lead Technician and the Rope Access Worker, to the extent that it does not prevent the effective performance of the Rope Access Supervisor's duties and responsibilities required by this section.

6.4 The Rope Access Supervisor shall have the authority to stop the work immediately if it is unsafe to proceed.

6.5 The Rope Access Supervisor shall:

6.5.1 Be responsible for the immediate supervision, implementation, and oversight of the rope access program at the worksite.

6.5.2 Have sufficient knowledge of current regulations that apply, directly or indirectly, to rope access and working at height, so as to ensure compliance by the employees being supervised.

6.5.3 Direct the efforts of other technicians to ensure safety and compliance with the rope access program.

6.5.4 Communicate and coordinate with clients and their safety representatives, and other contractors on the worksite where appropriate, regarding rope access safety and rescue procedures.

6.5.5 Identify all hazards to which employees may potentially be exposed on a rope access project, specify the means by which such hazards are to be controlled or eliminated prior to the commencement of work, and ensure that such elimination or control has been accomplished.

6.5.6 Specify the appropriate personal protective equipment (PPE) to be used by employees, ensure employees are properly trained in the use of such PPE in the rope access environment, and ensure employees use the PPE as required.

6.5.7 Identify work zones, ensure that these zones are marked appropriately, and verify that adequate measures are taken to keep other personnel and the public out of any affected areas.

6.5.8 Complete all required planning and documentation, including work permits, job safety analyses, and rescue plans as directed by the Rope Access Program Administrator prior to the commencement of rope access projects.

6.5.9 Review all procedures prior to the commencement of work and as worksite activities change to determine if additional practices, procedures, or training is needed in order to commence or continue work.

6.5.10 Conduct job site safety meetings with all affected personnel regarding applicable work permits, job safety analyses, rescue plans, or any other relevant information prior to commencement of the work.

6.5.11 Specify the appropriate rope access equipment, systems and system components, and supervise their installation, use, and inspection.

6.5.12 Verify that the necessary emergency services are available, including emergency medical services and ancillary rescue services (when applicable), and that the means to summon them are functioning.

6.5.13 The Rope Access Supervisor is responsible for on-site rescue of on-rope personnel. The supervisor shall:

6.5.13.1 Ensure that a prompt rescue of rope access personnel can be accomplished.

6.5.13.2 Manage or perform any rescue that may be required during the work.

6.5.13.3 Specify appropriate rescue procedures.

6.5.13.4 Perform or manage initial emergency care within the scope of the supervisor's training.

6.5.14 Remove from service any rope access equipment or other equipment (such as tools) that are used during rope access work that is damaged or has potentially sustained damage (such as from a significant shock load), until such time that it can be established that such equipment is safe for use.

6.5.15 Ensure that all equipment on the worksite is protected from damage and is maintained in a safe condition throughout the work.

6.5.16 Document and validate employee rope access hours in the manner prescribed by the Rope Access Program Administrator.

6.5.17 Perform any other duties designated in the employer's rope access program or identified by the Rope Access Administrator. Such duties remain within that Rope Access Supervisor's training, skills, experience and qualifications for conducting safe rope access operations and maintaining a safe rope access worksite.

6.6 Where it is determined that the use of ancillary rescue capability is required in the event rescue is needed during rope access operations, the supervisor shall coordinate with the provider of the ancillary rescue capability as required in the rescue section of this document.

7 DUTIES AND RESPONSIBILITIES OF THE LEVEL II TECHNICIAN (ROPE ACCESS LEAD TECHNICIAN)

7.1 A Rope Access Lead Technician shall have the appropriate training, experience, and qualifications to perform all rope access work, rigging and, at a minimum, standard rescue procedures under the direction of a Rope Access Supervisor.

7.2 A Rope Access Lead Technician may perform limited supervision over Rope Access Workers and other Technicians under the immediate direction of a Rope Access Supervisor. Such supervisory responsibilities may only be delegated to the Rope Access Lead Technician after:

7.2.1 The Rope Access Supervisor determines that the Rope Access Lead Technician is capable of providing limited supervision given the circumstances of the rope access work being performed; and

7.2.2 The Rope Access Supervisor determines that the Rope Access Lead Technician is prepared to handle all work variables and potential rescue requirements.

7.3 The Rope Access Lead Technician shall:

7.3.1 Adjust, inspect, maintain, properly use, care for, and store all rope access equipment necessary to perform the rope access work.

7.3.2 Utilize appropriate personal protective equipment as directed by the Rope Access Supervisor and the Employer's Rope Access Program.

7.3.3 Recognize worksite hazards, take corrective measures to eliminate or control those hazards, and notify the Rope Access Supervisor of all such hazards and the corrective measures taken.

7.3.4 Be capapble of indentifying work zones such as the access zone and hazard zone.

7.3.5 Understand and follow the requirements of all applicable work permits and job safety analyses.

7.3.6 Have a working knowledge and understanding of the employer's rope access program and all applicable policy and procedures.

7.3.7 Follow the Rope Access Supervisor's directions regarding the work to be performed.

7.3.8 Notify the Rope Access Supervisor if assigned a task or responsibility beyond the Rope Access Lead Technician's training, skills, qualifications, or experience.

7.3.9 Understand and communicate any written and verbal warnings.

7.3.10 Construct, inspect, and analyze safe rope access systems.

7.3.11 Perform standard rescue procedures used by the employer for the specific work environment.

7.3.12 Perform any other duties designated in the employer's rope access program or identified by the Rope Access Administrator or Supervisor. Such duties must remain within that Rope Access Lead Technician's training, skills, experience and qualifications for conducting safe rope access operations and maintaining a safe rope access worksite.

7.3.13 The Rope Access Lead Technician shall have the authority to stop the work immediately if it is unsafe to proceed.

8 DUTIES AND RESPONSIBILITIES OF THE LEVEL I TECHNICIAN (ROPE ACCESS WORKER)

8.1 The Rope Access Worker shall have the appropriate training and qualifications for conducting standard rope access operations under the direct supervision of a Rope Access Supervisor or Rope Access Lead Technician and, at a minimum, limited rescue from rope access systems.

8.2 The Rope Access Worker shall:

8.2.1 Have a working understanding of the employer's rope access program and all applicable policy and procedures.

8.2.2 Inspect, maintain, care for, and store personal rope access equipment.

8.2.3 Inspect and verify the integrity of anchor systems and components.

8.2.4 Recognize worksite hazards and notify the Rope Access Supervisor of any such hazards.

8.2.5 Be capable of identifying work zones such as the access zone and the hazard zone.

8.2.6 Understand applicable work permits and job safety analyses.

8.2.7 Understand and communicate any written or verbal warnings.

8.2.8 Be familiar with rescue procedures and systems used by the employer, and assist in the performance of rescue from rope access systems.

8.2.9 Utilize appropriate personal protective equipment as designated by the Rope Access Supervisor.

8.2.10 Follow the Rope Access Supervisor's or, where appropriate pursuant to the requirements of the Safe Practices Document, the Rope Access Lead Technician's directions regarding the work to be performed.

8.2.11 Notify the Rope Access Supervisor if assigned a task or responsibility beyond the Rope Access Worker's training, skills, qualifications, or experience.

8.2.12 Perform any other duties designated in the employer's rope access program or identified by the Rope Access Administrator or Supervisor. Such duties remain within that Rope Access Worker's training, skills, experience and qualifications, for conducting safe rope access operations and maintaining a safe rope access worksite.

8.2.13 The Rope Access Worker shall have the authority to stop the work immediately if it is unsafe to proceed.

9 AUTHORIZED WORKER

Section Held For Authorized Worker

10 ROPE ACCESS EQUIPMENT

10.1 Components used in any system shall be compatible.

10.2 Any equipment chosen to support a person at height should be such that it cannot be accidentally removed, dislodged or become unfastened from the rope while a person is suspended from it.

10.3 *Harnesses
Harness performance and construction should comply with relevant, nationally recognized standards such as NFPA, UIAA, ANSI, ASTM.

10.4 *Carabiners
Carabiners and similar connectors with screw-gates or self-locking methods of closure are the only types that can provide the required level of security for this type of work. If used to clip onto steel cable, shackles or eye bolts, they should be constructed of steel or other suitably hard metals. Those that are to clip to any anchorage (e.g., hanger, eye bolts, or shackles) should be of such a design and size that they can rotate freely in them without hindrance and without loosening the anchorage. Minimum strength: 22 kN (5,000 lbs).

10.5 *Descenders
Descenders should give the user suitable control over the speed of descent and should not cause undue shock loads to the rope when braking. In addition they should not cause abrasion, plucking or stripping of the sheath under normal or expected use. They should be of a type that cannot become accidentally detached from the rope.

10.6 *Rope Grabs
Rope grabs should be of a type that will not slip at a static load below 2.25 kN (550 lbs). Rope grabs should be of a type that cannot be accidentally detached from the rope. Ascenders should be chosen so as to minimize the risk of damage to the rope when in use.

10.7 Ropes

10.7.1 *Ropes made from nylon or polyester will normally be the most suitable for rope access work. Ropes of other man-made materials might, however, be useful in specific situations. In such cases, great caution should be exercised in verifying their suitability for the work.

10.7.2 *Static or Low Stretch Ropes shall normally be used for ascending and descending on rope. Static or Low Stretch Ropes shall be of a kernmantle construction compliant with Cordage Institute 1801 Low Stretch and Static Kernmantle Life Safety Rope, and have a minimum breaking strength sufficient to supply the users' desired calculated system

safety factor. In no case shall the safety factor for a rope access system be less than 5:1.

10.7.3 Where a fall in excess of a factor .25 fall might occur, dynamic rope should normally be used in place of static or low stretch rope. Dynamic safety rope should be of a kernmantle construction compliant with UIAA/CE (or comparable) standards for single climbing ropes.

10.8 Webbing.
Webbing used shall have a minimum breaking strength of at least 17.5 kN (4,000 lbs) when new. High modulus fibers such as Spectra, Kevlar, Vectran and similar fibers with minimum elongation may break when subjected to shock loading and shall not be used where a shock load may be applied.

10.9 *Certification.
It is recommended that only equipment that has a current certificate of the safe working load or minimum breaking strength, or other certification as to reliability, should be used. A check should be made that all certificates are backed by either sample testing to failure, or proof testing on individual items, and a proven quality assurance program, in accordance with an appropriate standard. Equipment should be only used in the manner indicated by the manufacturer.

10.10 *Care and Inspection of Equipment

10.10.1 Employer shall demonstrate that all equipment is used, inspected and maintained in accordance with manufacturer's instructions. Provisions shall be made for the retirement of equipment as necessary.

10.10.2 Employer shall establish and monitor a procedure to ensure all items of equipment are inspected before each use.

10.10.3 Employer shall ensure that equipment is protected from damage during the course of its use.

11 ACCESS AND HAZARD ZONES

11.1 Access Zone

11.1.1 An Access Zone shall be established.

11.1.2 Anchorages should normally be established outside the Access Zone so that the workers can don their harnesses and helmets and attach themselves to the working line(s) before entering into the Access zone.

11.1.3 *Appropriate fall protection measures shall be used by any personnel entering the Access Zone.

11.2 Hazard Zone

11.2.1 A Hazard Zone shall be established and marked, blockaded or identified to warn rope access personnel and passers-by of hazards associated with the work being performed.

11.2.2 No one may enter the Hazard Zone unless they are wearing appropriate Personal Protective Equipment.

12 COMMUNICATION SYSTEMS

12.1 *An effective communications system shall be established prior to beginning work and should remain effective for all the time that work is actively taking place.

12.2 Radio systems or hardline communications equipment should be used for communication purposes

unless the area of work is such that all those involved are always visible to each other and within audible range.

13 USE OF SUSPENDED WORK PLATFORMS IN CONJUNCTION WITH ROPE ACCESS

13.1 A suspended temporary work platform should be utilized if the work is such that the Rope Access technician may become overtired or suffer restriction to their blood flow.

13.2 When such platforms are used in conjunction with rope access methods, the anchorages for the platform should be totally independent from anchors used by Rope Access technicians as main lines or safety lines.

13.3 Alternatively, support could be provided for the Rope Access technician by a comfort seat or strap incorporated into the harness system. This should be fitted in a manner that it does not detract from the harness being the primary means of safety.

14 TOOLS AND WORK EQUIPMENT

14.1 *All tools and equipment must be suitable for the work intended and compatible with rope access work. In particular, they shall not present a danger to the safe operation or integrity of the rope access system.

14.2 *Where the workers carry tools and equipment, appropriate steps shall be taken to prevent them being dropped or falling.

14.3 *All electrical equipment, plugs, sockets, couplers, leads, etc. should be suitable for the environment in which they will be used.

14.4 Power tools weighing more than 10 kg should be fitted with a separate suspension system secured to an independent anchorage. Anchorages and suspension ropes used for equipment should be clearly identified to avoid confusion with those used to support persons.

14.5 Moving parts of tools should be kept clear of the operator, power leads and the suspension equipment.

14.6 Appropriate grounding shall be provided for as necessary.

14.7 Any power tools that could cause injury to the users or access equipment shall be fitted with an automatic shut off switch that will interrupt the power and stop movement in the event of a mistake, accident, or emergency.

15 RESCUE AND EMERGENCY SERVICES

15.1 *The employer shall have a rescue plan for every rope access work site or project. The plan shall provide for the prompt rescue and safe extrication of a sick, injured or entangled worker. The plan shall include the following provisions:

15.1.1 The plan shall ensure that all persons conducting rope access work have been trained and competent to peform self rescue.

15.1.2 The plan shall ensure that sufficient rope access personnel trained and competent in partner rescue are present and available to perform a rescue in a manner appropriate for the mechanism of injury or the patient's medical condition.

15.1.3 The plan shall ensure that the supervisor is capabable of managing a rescue incident and where apporpriate, performing a rescue.

15.1.4 The plan shall include the information required to respond the appropriate emergency services.

15.2 Retrieval systems or methods shall be available on-site whenever a rope access worker is on-rope, unless use of the retrieval equipment would increase the overall risk of the rope access work, or would not contribute to the rescue of the rope access worker.

15.3 Retrieval procedures using retrieval systems should be practiced at regular intervals and before the start of any work at situations that are unfamiliar to the work team.

APPENDIX

A2.1 The documentation prepared by the employer describing how a particular job or jobs should be undertaken may have different titles such as access work plan, access permit, work plan and tailboard form.

A2.4.2 In general use a deviation anchor will not pull the rope system more than 15 degrees off of the vertical.

A2.6 Ascender-type rope grabs come in a variety of designs. Many of those designs are not appropriate to use as a connection to the safety line or for belaying a worker.

A2.9 A locking carabiner may include the standard screw-gate or other style carabiner in which a positive action is required to lock the gate.

A.2.9.3 May also be called auto-lock, quik-lok or some variation of those terms.

A2.10 Descender usually refers to a device attached to the operator and enables the operator to control the rate of descent down the rope. Many descenders may be attached to an anchor and used to control the rate of descent of a worker or equipment being lowered.

A2.16 The hazard zone is concerned with the risk that the public or other workers may be struck by a falling object. This includes the workers on-rope as well as anyone at ground level.

A2.17 The component of the Access Work Plan which indentifies hazards, the hazard mitigation methods and outlines requirements to promptly rescue the rope access worker may have different titles for different employers, but will contain the basic information. Names often used include job safety analysis, site specific safety plan, hazard analysis, tailboard form and risk assessment.

A2.27 Rope Access Technicians use a variety of rope based skills and equipment to access buildings, other structures (on or offshore), geological features (such as cliff faces), or manmade features (such as dams). A rope is used as the primary means of support and a safety rope is used to attach the fall arrest system. Rope access may also include the use of aid climbing techniques.

A2.28 Climbing and aid climbing techniques used by rope access technicians may use techniques other than a safety line for fall protection such as positioning lanyards, backup lanyards and bypass lanyards.

A3.3 Before starting a particular job the employer shall carefully assess the work to be undertaken and ensure that all the potential hazards are identified. A site survey is required to determine the means of access, risks to people other than the employees and the nature of the working environment. From this assessment, employers can then prepare a suitable work plan, with necessary separate work plans being prepared for each particular aspect of the job. This statement should set out the general principles and working procedures for each particular situation which are to be followed by their employees and by independent contractors used. In many cases where types of jobs are similar, sections of the rope access work plan could be identical and might therefore be in the form of a general document.

A3.3.2 The Rope Access Administrator shall assess the individual team member's suitability for the work to be performed.

A3.4 Personnel permitting, planning, supervising and carrying out the work should ensure that the safety objectives given in the following paragraphs are met.

- The primary objective is to organize, plan and manage rope access work so that there will be an adequate safety margin to minimize any risks.

- Where the work site contains additional hazards, then the training, ability, experience, competence and size of the work team should be of a level that is suitable to deal with any emergency arising out of the work.

- In circumstances where wet synthetic ropes may become a tracking path for electrical discharges, suitable precautions should be taken.

- Except where work is laid out to allow horizontal traversing, work shall be planned such that workers can descend vertically, with the minimum amount of pendulum to minimize the risk of chafing the rope or overloading the rope or anchors.

- Work should start from properly protected safe areas or areas made safe by the installation of temporary barriers or scaffolding. Such areas should also have a safe means of access.

- Anchors should have safety factors that meet or exceed those required for the ropes. The attachment to the anchorage should at least equal the strength of the system attached to it. Re-direction of a rope from an anchor should not exceed 120 degrees unless the side loads produced at the redirection point are considered. Similarly, where the included angle at the attachment is high and produces a 'multiplier' effect, the extra forces produced should be considered.

- All rope access workers should be properly supervised and self-supportive. Work teams should consist of at least the minimum number of members required to ensure that should anyone require help they can quickly perform a rescue. To meet the above requirement, a work team should consist of at least two members. One member of the work team should be qualified as a Rope Access Supervisor or Lead Technician. The Rope Access Supervisor should ensure that the provisions for rescue are adequate. Sufficient personnel should be readily available to provide assistance in the event of an emergency.

A3.5 Properly planned anchorages should be used. In some cases, anchorages must be installed prior to use. In such cases, a qualified person with experience in Rope Access Anchoring Systems should design an anchor point to be installed. In other cases, there will be a need to devise an anchor point from existing structures. Possible appropriate anchor points include but are not limited to steel members, I-beams, suitable trees of good size and mass, large boulders, heavy equipment and specially designed anchor points.

A3.6.1 In planning to meet these objectives, it should be noted that experience has shown significant safety benefits may be obtained if the system of work always includes the provision of at least one alternative means of support to prevent a person from falling. This means that should any one item fail within the suspension system, there will be an adequate back-up to prevent a catastrophic accident. However, in some situations such additional measures may cause greater hazard than they mitigate. These situations should be thoroughly documented in Rope Access Work Plan.

A4.8 People chosen for the work should have a suitable attitude for working at height. To work safely at height requires those engaged in the work to have special characteristics. Prospective employees should have both aptitude and attitude that would not result in panic, cause them to make mistakes in a crisis, or work in a reckless or undisciplined manner. Aptitude and attitude may vary according to height and environment of work to be performed.

- Frequently those who work at height will be remote or out of sight from their Rope Access Supervisor. It is, therefore, especially important that the workers can be always relied upon to behave in a sensible and responsible manner.

- To assess whether a person is capable of performing this type of work requires detailed consideration of their previous experience. The employer should verify prior rope access training experience.

- Other suitable experience could include mountaineering, caving and working at heights using other means of access. Experience with the fire service or military forces may also be relevant if a person has been regularly engaged in the use of methods that involve being exposed at heights. Where practicable, references should be obtained to verify claimed experience and levels of competence.

- The employer will be assisted in their verification and monitoring of a worker's experience when their workers or applicants have a personal record log showing the training received and describing their work experience.

- As part of their duties to maintain a safe place of work, the employer should control any tendency of employees to work in an undisciplined manner by recording this in their personal log books. An amending note canceling any adverse comments would not then be made until the employer is completely satisfied that there would be no recurrence.

- Employees must ensure that the employees maintain their level of ability. Refresher training should be provided for workers who have not been continuously engaged in this work. Due to the aptitude and mental conditioning for height 'exposure', workers who have not been engaged in rope access work for six months or more should attend a suitable refresher course before being allowed to work in this manner. This may be either a refresher course or a full course at the appropriate level.

© 2012 Society of Professional Rope Access Technicians

A5.1 The Rope Access Program Administrator will be responsible for setting up the employer's Rope Access Program and developing or approving the Rope Access Work Plan. At minimum, the administrator should have the knowledge and experience of a Level III Technician (Rope Access Supervisor) if not a certified Level III Technician. The administrator should also be knowledgeable about and experienced in supervising fall protection programs and in particular fall protection systems for rope access work.

A5.2.5 Appropriate supervision may not always require an administrator or supervisor to be on-site. Depending on the nature of the work and the qualifications of the workers, the on-site supervisor may not be required if it can be shown that the safety of the workers has not been decreased.

A10.3 Where the harness is to be used as the primary support, webbing on the leg loops should be of sufficient width and design to support the wearer in a comfortable and safe working position while allowing unhindered operation of other equipment and tools.

A10.4 Strengths listed are for single person loads. Higher strengths may be required to achieve similar safety factors for two person or rescue loads.

A10.5 For long descents, consideration should be given to the effect of rope-weight on descender performance. Consideration should also be given to reducing cumulative twisting of the rope.

A10.6 Rope grabs may be used to ascend a rope or to attach the operator to a safety line. In the event of a failure of the main line or loss of control by the operator, rope grabs are intended to grip the safety rope without causing damage to the rope and also help absorb any shock load which may occur.

A10.7.1 Ropes made from high modulus polyethylene, high tenacity polypropylene and "Kevlar" are types of ropes which may be considered in exceptional circumstances when the appropriate descent devices have been developed. These might be useful where there is severe chemical pollution or where the self weight of the ropes could be a problem. However, H.M. polyethylene and H.T. polypropylene have much lower melting temperatures than nylon or polyester and may be affected by frictional heat from the descenders. Dangerous softening of polypropylene occurs at temperatures as low as 27 degrees C (80 degrees F). Kevlar has a very high melting point but poor resistance to abrasion, UV light (including sunlight) and repeated bending.

A10.7.2 Life Safety Ropes should be selected which have an outer sheath that resists undue wear from edges and system components and tight enough to resist the ingress of dirt and grit. In most cases, this rope will be low stretch rope.

An example of calculating system safety factors is as follows: a 68 kg (150-pound) worker, to achieve a 5:1 safety factor, must work on a system where the weakest link of the system is calculated to be capable of sustaining at least 340 kg (750 pounds).

A10.9 Part of the permitting process for rope access work is the evaluation and determination of which standards apply to equipment being used for the type of work being done. Conventional "fall protection" equipment rated to ANSI A10.14 or Z359.1 may not be sufficient for rope access work due to different construction and performance requirements. Most equipment will meet a CE, ASTM, Cordage Institute or NFPA standard. The most critical element is to ensure that the equipment being used is appropriate for the job at hand.

A10.10 Records listing all equipment issued, referring to the original test or certificates of conformity should be kept. In some cases it will be helpful if they also have relevant comments noting where the equipment was used, its storage conditions, and any incidents which could affect its life (e.g., unusual loadings, use in chemical or gritty atmosphere, exposure to salt-air, etc.). The records shall note when each piece of equipment was inspected, by whom and any remarks concerning its condition at that time.

A11.1.3 Personnel in the Access Zone may require fall protection meeting the requirments of the jurisdcition or country of the work, such as ANSI/ASSE, CSA or EN/CE, during transistion until the rope access anchors are established and personnel are on-rope.

A12.1 Hand or audible signals to be used for regular or emergency communications should be agreed upon and rehearsed before work begins.

A14.1 Work using rope access techniques may be more exposed than most other work methods due to factors including the inability of the worker to move from close proximity to the work itself and to any power source or tools being used. As a result certain tools, which can be used safely from the ground, platforms, or other work surfaces, could cause risks to the worker or their suspension equipment unless great care is taken.

A14.2 Every effort must be made to prevent tools and equipment from being dropped. This effort may require lanyards or for small items, some other means for preventing items being dropped. Small tools may be securely attached to the worker's harness by lanyards, carried in a bucket or bag securely attached to the worker's harness or otherwise secured. Safety factor calculations always take into consideration the weight of tools and equipment.

A14.3 In some cases power leads might need to be adequately supported or secured at their upper suspension point to carry their own weight, or secured at intermediate points. Care should be taken to ensure that any such systems do not impair the rope access system or its backup.

A15.1 A rope access rescue plan recognizes that the best trained persons to perform the rescue of a sick, injured or entangled worker may be other rope access workers. Fellow workers have the training and skills for work at height, have practiced rescue techniques on-rope, and are immediately on site. In most cases they can have the worker at risk on the ground by the time the local emergency services arrive.

CONTACT INFORMATION

Society of Professional Rope Access Technicians
994 Old Eagle School Road, Suite 1019
Wayne, PA 19087-1866
610-971-4850
info@sprat.org

Submittal 900.620

Rock Anchor Testing

Submittal 900.640

Rock Anchor

Paragraph 29.b,2

Work Plan

Details of rock anchor type, couplings, face plate and nut, and method of installation for grout tubes and centralizers

MIDWEST ROCKFALL, INC. **WORK PLAN**	Project No.: 0297(8)	Item Description: Rock Anchor	
	Project Name: HighGate STP	Item No:	
	Location: HighGate , VT		Quantity / Units 350LF
	Prepared By: Luke Fetzer		Date: 6/17/2013

Work Description	WORK PLANS
Rope Access Method	Workers will access the slope using the SPRAT method. Safety plan attached seperately
Rock Anchor Type and Calibration Data	Williams Form Engineering catalog cuts and Calabration Data attached seperatley
Mill Certification	Avalable when Material is dellivered to the project site
Rock Anchor Installation	Rock anchors will be installed using a Marini drill slide and a 4" Atlas Copco DTH. Once the hole is flushed clean of any debris workers will insert the anchor with centralizers and tremmie tube attached assuring the hole is free from obstructions. Next workers will attach the grout hose and begin grouting Type 1 Type 2 portland with a Chemgrout pressurized grout pump until hole is full and then fill the "birds beak" after initial grout has cured. During the erection of the gabion wall workers will attach couplings and threadbar to pertrude through the gabions and then attaching the bearing plates, nuts, and washers and then torquing the nuts to the required load

Work Description	Labor Type	QTY	Units	Units / Day	Total Days	Hours / Day	Days / Week	Reg. Hrs	O.T. Hrs	Total Hours
Rock Anchoring	Driller	LF	350	100	3.5	10	3.5	35	0	35
									TOTAL WORKING DAYS	4

Work Description	Equipment	QTY	Rental Period	Standby Hrs	Operating Hrs
Anchor Installation	Mini Excavator	1	0	10	40
Anchor Installation	375 CFM air compressor/ Marini Drill Slide	1	0	10	40
			0		

Quantity	Units	Material Description	ASTM / AASHTO
350	LF		Material Data Sheets Attached
		Grout	Separately
		Threaded Bar and Accessories	

Description	Reference	Quality Assurance	Additional Attachments
		Field Tested Anchors	
		Certificates of Conformance	

MWR FORM 505

MIDWEST ROCKFALL, INC

10401 E 102nd ave
Henderson, CO 80640
p 303.288.4970
f 303.288.4986

August 15, 2013

Highgate STP 0297(8)

To:
Chris Belanger
ECI
From:
Luke Fetzer
MWR Project Manager
10401 East 102nd Avenue
Henderson, CO 80640
303-288-4970
Fax: 303-288-4970

MWR Project Manager

Mr. Belanger,

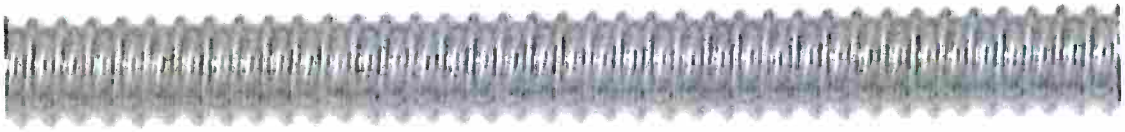
This letter is to inform you that Midwest Rockfall Inc. will use only galvanized materials for the above mentioned project in accordance with the specifications.

Luke Fetzer,

WILLIAMS FORM ENGINEERING CORP.

WILLIAMS CONCRETE ACCESSORIES DIVISION

Grade 75 All-Thread Rebar



Structural Properties	
Minimum Yield	Ultimate Tensile
75 KSI (517 MPa)	100 KSI (689 MPa)
Typical Elongation in 8" bar	
7%-9%	

Unique Thread Form

R61 Grade 75 All-Thread Rebar - ASTM A615

Bar Desig. & Nominal Dia.	Minimum Net Area Thru Threads	Minimum Ultimate Strength	Minimum Yield Strength	Nominal Weight	Approx. Thread Major Dia.	Part Number
#6 - 3/4" (20 mm)	0.44 in^2 (284 mm^2)	44 kips (196 kN)	33 kips (147 kN)	1.5 lbs./ft. (2.36 Kg/M)	7/8" (22.2 mm)	R61-06
#7 - 7/8" (22 mm)	0.60 in^2 (387 mm^2)	60 kips (267 kN)	45 kips (200 kN)	2.0 lbs./ft. (3.04 Kg/M)	1" (25.4 mm)	R61-07
#8 - 1" (25 mm)	0.79 in^2 (510 mm^2)	79 kips (351 kN)	59.3 kips (264 kN)	2.7 lbs./ft. (3.94 Kg/M)	1-1/8" (28.6 mm)	R61-08
#9 - 1-1/8" (28 mm)	1.00 in^2 (645 mm^2)	100 kips (445 kN)	75 kips (334 kN)	3.4 lbs./ft. (5.06 Kg/M)	1-1/4" (31.8 mm)	R61-09
#10 - 1-1/4" (32 mm)	1.27 in^2 (819 mm^2)	127 kips (565 kN)	95.3 kips (424 kN)	4.3 lbs./ft. (5.50 Kg/M)	1-3/8" (34.9 mm)	R61-10
#11 - 1-3/8" (35 mm)	1.56 in^2 (1006 mm^2)	156 kips (694 kN)	117 kips (521 kN)	5.3 lbs./ft. (7.85 Kg/M)	1-1/2" (38.1 mm)	R61-11
#14 - 1-3/4" (45 mm)	2.25 in^2 (1452 mm^2)	225 kips (1001 kN)	169 kips (750 kN)	7.65 lbs./ft. (11.8 Kg/M)	1-7/8" (47.6 mm)	R61-14
#18 - 2-1/4" (55 mm)	4.00 in^2 (2581 mm^2)	400 kips (1779 kN)	300 kips (1335 kN)	13.6 lbs./ft. (19.6 Kg/M)	2-7/16" (61.9 mm)	R61-18
#20 - 2-1/2" (64 mm)	4.91 in^2 (3168 mm^2)	491 kips (2184 kN)	368 kips (1637 kN)	16.7 lbs./ft. (24.8 Kg/M)	2-3/4" (69.9 mm)	R61-20
#24 - 3" (76 mm)	6.82 in^2 (4400 mm^2)	682 kips (3034 kN)	511 kips (2273 kN)	24.0 lbs./ft. (35.8 Kg/M)	3-3/16" (81 mm)	R61-24
#28 - 3-1/2" (89 mm)	9.61 in^2 (6200 mm^2)	960 kips (4274 kN)	720 kips (3206 kN)	32.7 lbs./ft. (48.6 Kg/M)	3-3/4" (95.0 mm)	R61-28

Sizes

All-Thread Rebar is available in 11 diameters from #6 (20 mm) through #28 (89 mm). Most diameters are available in continuous lengths up to 50' (15.2 m).

Threads

Williams Grade 75 All-Thread Rebar has a cold rolled, continuous, rounded course thread form. Because of the full 360° concentric thread form, Williams All-Thread Rebar should only be bent under special provisions. Williams special thread (deformation) pattern projects ultra high relative rib area at 3 times that of conventional rebar. This provides for superior bond performance in concrete. Threads are available in both right and left hand. Grade 80 is available upon request.

Welding

Welding of All-Thread Rebar should be approached with caution since no specific provisions have been included to enhance its weldability. Refer to ANSI/AWS D1.4 for proper selections and procedures.

Threaded Bar Types | Grade 75 Information | Grade 75 Accessories | Case Histories | Corrosion Protection

Contact Us | Home

© 2011 Williams Form Engineering Corp. All rights reserved.

* #28 - 3-1/2" (89 mm)	5" (127 mm)	2-1/2" (63.5 mm)	R64-28JN

* Round Collar Nut

R8M Beveled Washers - ASTM A47 or ASTM A536

Nominal Bar Diameter	Degree of Bevel	Outside Diameter	Inside Diamter	Maximum Thickness	Minimum Thickness	Part Number
#6 - 3/4" (20 mm)	9°	2" sq. (50.8 mm)	1" (25.4 mm)	17/32" (13.5 mm)	15/64" (6.1 mm)	R8M-07
#7 - 7/8" (22 mm)	9°	2" (50.8 mm)	1-3/16" (30.2 mm)	9/16" (14.3 mm)	1/4" (6.4 mm)	R8M-09
#8 - 1" (25 mm)	15°	2-13/16" (71.4 mm)	1-5/16" (33.3 mm)	1" (25 mm)	5/16" (7.9 mm)	R8M-09S
#9 - 1-1/8" (28 mm)	15°	2-13/16" (71.4 mm)	1-5/16" (33.3 mm)	1" (25 mm)	5/16" (7.9 mm)	R8M-09S
#10 - 1-1/4" (32 mm)	15°	3-3/8" (85.7 mm)	1-9/16" (39.7 mm)	1-15/64" (43.9 mm)	3/8" (9.7 mm)	R8M-12S
#11 - 1-3/8" (35 mm)	15°	3-1/2" (88.9 mm)	1-3/4" (44.5 mm)	1-1/4" (31.8 mm)	3/8" (9.7 mm)	R8M-13S
#14 - 1-3/4" (45 mm)	5°	3-9/16" (90.5 mm)	2-1/16" (52.4 mm)	13/16" (20.6 mm)	1/2" (12.7 mm)	R8M-16
#18 - 2-1/4" (55 mm)	15°	5" (127 mm)	3" (76.2 mm)	5/8" (41.4 mm)	19/64" (7.6 mm)	R8M-18
#20 - 2-1/2" (64 mm)	10°	5-1/2" (140 mm)	3" (76.2 mm)	1-23/32" (43.7 mm)	3/4" (20 mm)	R8M-20
#24 - 3" (76 mm)	10°	7" (178 mm)	3-5/8" (92 mm)	2" (51 mm)	3/4" (20 mm)	R8M-24
#28 - 3-1/2" (89 mm)	10°	8" (203 mm)	4" (102 mm)	2-19/64" (58.1 mm)	7/8" (22 mm)	R8M-28

Steel Plates

S1K - Round

R80 - Dished

S1K - Keyhole

S0K - Studded

S2K - Domed

Williams steel bearing plates are standard with a round hole for non-grouted ground anchors. Also available are dished plates for use with spherical hex nuts and keyhole plates which provide free access for grout tube entry. Bearing plates are customized for each application. Plate dimensions should be specified around the parameters of the project. In addition, corrosion protection should be considered along with specifying hole diameter and bar angle.

R81 Spherical Washers - ASTM A536

Nominal Bar Diameter	Thickness	Outside Dome	Part Number
#6 - 3/4" (20 mm)	35/64" (13.9 mm)	2" (51 mm)	R81-0675
#7 - 7/8" (22 mm)	39/64" (15.5 mm)	2-1/4" (57 mm)	R81-0775
#8 - 1" (25 mm)	5/8" (15.9 mm)	2-1/2" (64 mm)	R81-0875
#9 - 1-1/8" (28 mm)	3/4" (19.1 mm)	2-3/4" (70 mm)	R81-0975
#10 - 1-1/4" (32 mm)	53/64" (21.0 mm)	3-1/8" (79.4 mm)	R81-1075
#11 - 1-3/8" (35 mm)	29/32" (23.0 mm)	3-1/8" (79.4 mm)	R81-1175
#14 - 1-3/4" (45 mm)	1-7/64" (28.2 mm)	4" (102 mm)	R81-1475
#18 - 2-1/4" (55 mm)	1-13/32" (35.7 mm)	5" (127 mm)	R81-1875
#20 - 2-1/2" (64 mm)	1-1/2" (38.1 mm)	5-1/4" (133 mm)	R81-2075
#24 - 3" (76 mm)	1-7/8" (48 mm)	6" (165 mm)	R81-2475
#28 - 3-1/2" (89 mm)	1-1/2" (38.1 mm)	7" (178 mm)	R81-2875

R63-JN Jam Nuts - ASTM A108

These Jam Nuts can not be substituted for full strength nuts and can't be used on bars other than Williams Grade 75 All-Thread Rebars of the same diameter.

Nominal Bar Diameter	Across Flats	Overall Length	Part Number
#6 - 3/4" (20 mm)	1-1/4" (32 mm)	13/16" (20.6 mm)	R63-06JN
#7 - 7/8" (22 mm)	1-7/16" (36.5 mm)	7/8" (22.2 mm)	R63-07JN
#8 - 1" (25 mm)	1-5/8" (41 mm)	1" (25 mm)	R63-08JN
#9 - 1-1/8" (28 mm)	1-7/8" (47.6 mm)	1" (25 mm)	R63-09JN
#10 - 1-1/4" (32 mm)	2" (51 mm)	1-3/16" (27.7 mm)	R63-10JN
#11 - 1-3/8" (35 mm)	2-1/4" (57 mm)	1-1/4" (31.8 mm)	R63-11JN
#14 - 1-3/4" (45 mm)	2-3/4" (70 mm)	1-5/8" (41.3 mm)	R63-14JN
#18 - 2-1/4" (55 mm)	3-1/2" (89 mm)	1-3/4" (44.5 mm)	R63-18JN
#20 - 2-1/2" (64 mm)	4" (102 mm)	2" (50.8 mm)	R63-20JN
* #24 - 3" (76 mm)	4-1/2" (114 mm)	2-1/4" (57 mm)	R64-24JN

Nominal Bar Diameter	Outside Diameter	Overall Length	Part Number
#6 - 3/4" (20 mm)	1-1/4" (31.8 mm)	3-1/2" (88.9 mm)	R62-06
#7 - 7/8" (22 mm)	1-3/8" (35.1 mm)	4" (102 mm)	R62-07
#8 - 1" (25 mm)	1-5/8" (41.4 mm)	4-1/2" (114 mm)	R62-08
#9 - 1-1/8" (28 mm)	1-7/8" (47.7 mm)	5" (127 mm)	R62-09
#10 - 1-1/4" (32 mm)	2" (50.8 mm)	5-1/2" (140 mm)	R62-10
#11 - 1-3/8" (35 mm)	2-1/4" (57.2 mm)	6" (152 mm)	R62-11
#14 - 1-3/4" (45 mm)	2-7/8" (73.0 mm)	7-7/8" (200 mm)	R62-14
#18 - 2-1/4" (55 mm)	3-1/2" (88.9 mm)	9-1/8" (233 mm)	R62-18
#20 - 2-1/2" (64 mm)	4" (102 mm)	9-1/2" (241 mm)	R62-20
#24 - 3" (76 mm)	5" (127 mm)	11-1/4" (286 mm)	R62-24
#28 - 3-1/2" (89 mm)	5-1/2" (140 mm)	12" (305 mm)	R62-28

R9F Hardened Washers - ASTM F436

Nominal Bar Diameter	Outside Diameter	Inside Diamter	Thickness	Part Number
#6 - 3/4" (20 mm)	1-3/4" (45 mm)	15/16" (24 mm)	5/32" (3.4 mm)	R9F-07-436
#7 - 7/8" (22 mm)	2" (51 mm)	1-1/8" (28 mm)	5/32" (4.0 mm)	R9F-08-436
#8 - 1" (25 mm)	2-1/4" (57 mm)	1-1/4" (32 mm)	5/32" (4.0 mm)	R9F-09-436
#9 - 1-1/8" (28 mm)	2-1/4" (57 mm)	1-1/4" (32 mm)	5/32" (4.0 mm)	R9F-09-436
#10 - 1-1/4" (32 mm)	2-1/2" (64 mm)	1-3/8" (35 mm)	5/32" (4.0 mm)	R9F-10-436
#11 - 1-3/8" (35 mm)	3" (76 mm)	1-5/8" (41 mm)	5/32" (4.0 mm)	R9F-12-436
#14 - 1-3/4" (45 mm)	3-3/8" (86 mm)	1-7/8" (48 mm)	9/32" (7.1 mm)	R9F-14-436
#18 - 2-1/4" (55 mm)	4-1/2" (114 mm)	2-5/8" (67 mm)	9/32" (7.1 mm)	R9F-20-436
#20 - 2-1/2" (64 mm)	5" (127 mm)	2-7/8" (73 mm)	9/32" (7.1 mm)	R9F-22-436
#24 - 3" (76 mm)	6" (142 mm)	3-3/8" (86 mm)	5/16" (7.9 mm)	R9F-24-436
#28 - 3-1/2" (89 mm)	7" (178 mm)	3-7/8" (98 mm)	5/16" (7.9 mm)	R9F-30-436

WILLIAMS FORM ENGINEERING CORP.

WILLIAMS CONCRETE ACCESSORIES DIVISION

Grade 75 All-Thread Rebar Accessories

We offer a number of component parts and accessories for our Grade 75 All-Thread Rebar. All Hex Nuts and Couplings exceed 100% of the bar's published ultimate strength and meet ACI 318 Section 12.14.3.2 for mechanical rebar connections.

Hex Nuts
Hardened Washers
Jam Nuts
Steel Plates
Stop-Type Couplings
Spherical Washers
Bevel Washers

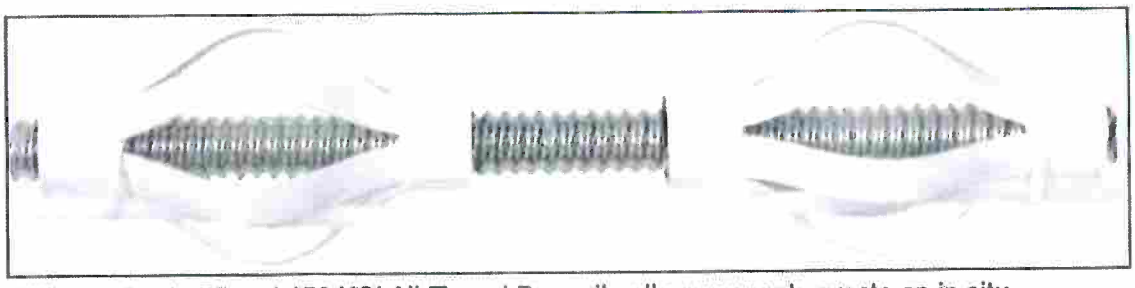
R63 Hex Nuts - ASTM A108

Nominal Bar Diameter	Across Flats	Across Corners	Thickness	Part Number
#6 - 3/4" (20 mm)	1-1/4" (31.8 mm)	1.44" (36.7 mm)	1-5/8" (41.4 mm)	R63-06
#7 - 7/8" (22 mm)	1-7/16" (36.5 mm)	1.66" (42.2 mm)	1-3/4" (44.5 mm)	R63-07
#8 - 1" (25 mm)	1-5/8" (41.3 mm)	1.88" (47.7 mm)	2" (50.8 mm)	R63-08
#9 - 1-1/8" (28 mm)	1-7/8" (47.8 mm)	2.17" (55.0 mm)	2" (55.5 mm)	R63-09
#10 - 1-1/4" (32 mm)	2" (50.8 mm)	2.31" (58.6 mm)	2-3/16" (55.6 mm)	R63-10
#11 - 1-3/8" (35 mm)	2-1/4" (57.2 mm)	2.53" (64.2 mm)	2-13/32" (61.1 mm)	R63-11
#14 - 1-3/4" (45 mm)	2-3/4" (69.9 mm)	3.18" (80.6 mm)	3-1/4" (82.6 mm)	R63-14
#18 - 2-1/4" (55 mm)	3-1/2" (88.9 mm)	4.04" (103 mm)	3-1/2" (88.9 mm)	R63-18
#20 - 2-1/2" (64 mm)	4" (102 mm)	4.62" (117 mm)	4" (102 mm)	R63-20
* #24 - 3" (76 mm)	4-1/2" (114 mm)	O.D. 5" (127 mm)	5" (127 mm)	R64-24
* #28 - 3-1/2" (89 mm)	5-1/2" (140 mm)	O.D. 6" (142 mm)	6" (142 mm)	R64-28

* Rounded collar Nut

R62 Stop-Type Couplings - ASTM A108

Soil Nail System



Williams Grade 75 and 150 KSI All-Thread-Bar soil nail components create an in-situ reinforcement system for the stabilization of excavations and slopes during top-down construction. Oversized holes of 4" to 10" in diameter are drilled and the centralized soil nail component is placed. The drill hole is then tremie grouted with Williams Wil-X-Cement grout. After the drill hole grout is cured, the soil nails may be torque tensioned against the protective shotcrete face to a slight load if desired.

Suggested working loads on common soil nails should not exceed 60% of the bar's ultimate strength. Pull out capacity is a function of drill hole diameter, depth, over burden stress and the angle of internal friction of the in-situ soil. Field tests are recommended to establish necessary bond lengths. However, typical anchorages in granular soils have yielded pull out strengths of 2-10 kips per foot of embedment on lengths over 10 feet.

Williams All-Thread Soil Nails Offer:

- Rugged thread with precision fit for durability and ease of use.
- 360° of concentric thread for unmatched grout to bar bond.
- Mechanical stop-type couplers able to develop 100% of the bar's tensile capacity for the most reliable bar to bar connections available.
- Grades 75 and 150 KSI with full circular effective areas.
- Several options of corrosion protection including epoxy coating, galvanizing, cement grout and multiple corrosion protection for both temporary and permanent use.
- Manufacturing versatility unmatched by any soil nail supplier in North America.
- Connection abilities with structural and non-structural wall face attachments.

Cross Section of factory grouted duct and bar.

Submittal 900.620

Rock Anchor Testing

Submittal 900.640

Rock Anchor

Paragraph 29. B, 3

Work Plan

Calibration certificates for equipment to be used for rock anchor installation and testing

Rock Anchors will be tested at a maximum of

1.33 (DL). The anchors will be tested cyclically starting at a load of0.25 (DL) to the max of 1.33 (DL) using 6 cycles. DL for the rock anchors is 11.2 kips

MIDWEST ROCKFALL, INC

10401 E 102nd ave
Henderson, CO 80640
p 303.288.4970
f 303.288.4986

August 15, 2013

Highgate STP 0297(8)

To:
Chris Belanger
ECI
From:
Luke Fetzer
MWR Project Manager
10401 East 102nd Avenue
Henderson, CO 80640
303-288-4970
Fax: 303-288-4970

MWR Project Manager

Mr. Belanger,

This letter is to inform you that Midwest Rockfall Inc. will perform 13 anchor tests based on the literature in this contract. Locations of the test will be determined in the field base on the daily drill logs executed by Midwest Rockfall Inc.

Luke Fetzer,

CTL | THOMPSON
MATERIALS ENGINEERS, INC.

August 8, 2013

Midwest Rockfall, Inc.
10401 E. 102nd Avenue
Unit 3
Henderson, CO 80640

Attention: Mr. Bryan Love

Subject: Hydraulic Ram Load Verification
30 Ton Ram Calibration
Project No. CT 15565.003-435

Dear Mr. Love:

This report presents load verification results for a hydraulic ram system delivered to our laboratory on July 25, 2013. The system consisted of an SPX Power Team S/N 1554944, 30 ton hydraulic ram, a SPX Power Team electric pump S/N # 9517 and a SPX Power Team 10,000 psi, 2" gauge. The loads were verified using our Tinius Olsen compression testing machine with a load capacity of 300,000 pounds. Calibration of our test machine is performed annually and was last calibrated in March 14, 2013.

Gauge pressure and the corresponding load were measured three times over the load range for the system. The results were averaged to determine a linear equation for the load in pounds versus the gauge pressure in psi. The results of the load verification are presented numerically in Table 1. The graph presenting load versus the gauge pressure is attached.

If you have any questions regarding this report, please feel free to contact us.

Respectfully submitted,

CTL | THOMPSON MATERIALS ENGINEERS, INC.

Daniel L. Barrett

Daniel L. Barrett
Materials Lab Manager

Reviewed By:

Damon B. Thomas, P.E.
Division Manager

DLB:DBT/dlb

1 copy sent
1 copy emailed: bryanl@midwestrockfall.com

This test report relates only to the items tested and shall not be reproduced, except in full, without written approval of CTL Thompson, Inc.

TABLE 1

LOAD VERIFICATION DATA FOR HYDRAULIC RAM SYSTEMS

Client: Midwest Rockfall, Inc.
Calibration Date: July 25, 2013
Ram ID: SPX Power Team 30 Ton S/N 1554944
Pump ID: SPX Power Team Electric # 9517
Gauge ID: SPX Power Team 2" 10,000 psi

Gauge Pressure (psi)	Average Load (lbs)
1,000	5,090
2,000	12,430
3,000	18,640
4,000	25,180
5,000	31,280
6,000	37,750
7,000	43,790
8,000	50,090
9,000	55,880

Project No. CT15565.003-435
Report Date: August 8, 2013

This test report relates only to the items tested and shall not be reproduced, except in full, without written approval of CTL Thompson, Inc.

HYDRAULIC RAM CALIBRATION

Client: Midwest Rockfall, Inc.
10401 E. 102nd Avenue
Unit 3
Henderson, Colorado, 80640
Attention: Bryan Love

Report Date: August 8, 2013
Calibration Date: July 25, 2013
Project Name: Ram Calibration

Project No. CT15565.003-435

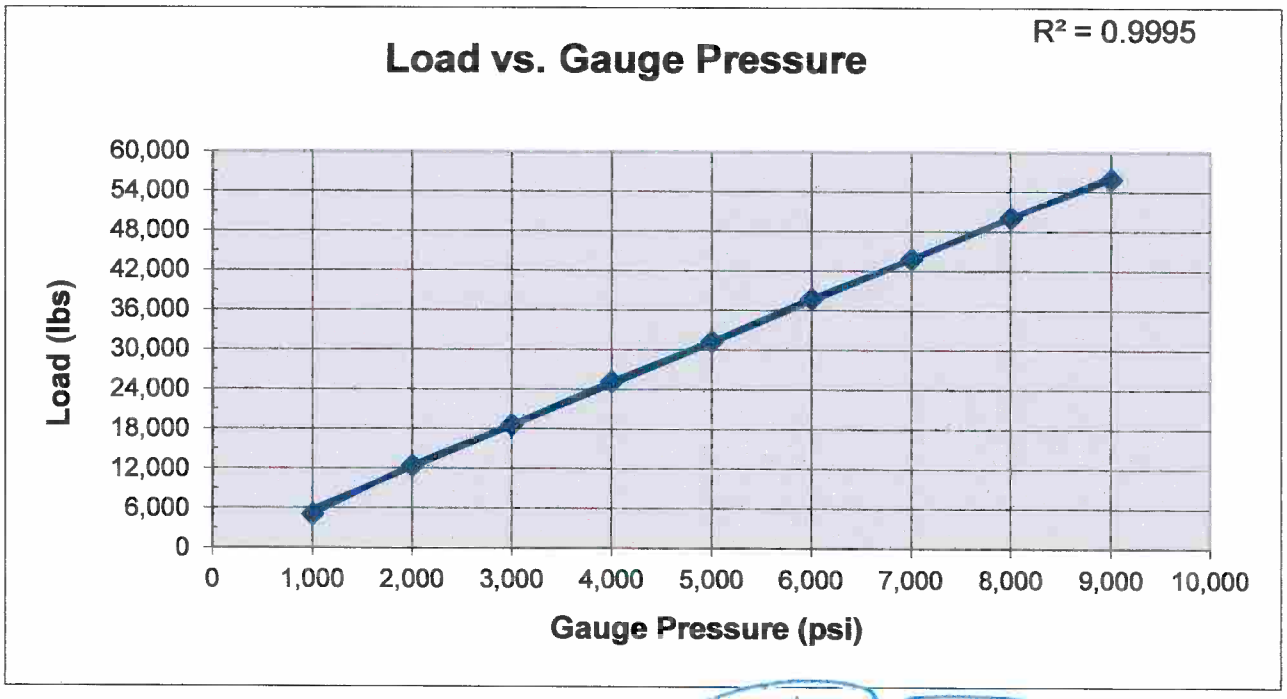
Ram ID: SPX Power Team 30 Ton S/N 1554944
Pump ID: SPX Power Team Electric # 9517
Gauge ID: SPX Power Team 2" 10,000 psi

Laboratory Equipment: Tinius Olsen 300K S/N 19962-CTO 191 Calibrated March 14, 2013

Equations

Gauge Pressure = 0.158 * Load +75

Load = 6.32 * Gauge Pressure -459



Damon B. Thomas, P.E.

This test report relates only to the items tested and shall not be reproduced, except in full, without written approval of CTL Thompson, Inc.

CTL | THOMPSON
MATERIALS ENGINEERS, INC.

August 8, 2013

Midwest Rockfall, Inc.
10401 E. 102nd Avenue
Unit 3
Henderson, CO 80640

Attention: Mr. Bryan Love

Subject: Hydraulic Ram Load Verification
30 Ton Ram Calibration
Project No. CT 15565.003-435

Dear Mr. Love:

This report presents load verification results for a hydraulic ram system delivered to our laboratory on July 25, 2013. The system consisted of an SPX Power Team S/N 1554949, 30 ton hydraulic ram, a SPX Power Team electric pump S/N # 9517 and a SPX Power Team 10,000 psi, 2" gauge. The loads were verified using our Tinius Olsen compression testing machine with a load capacity of 300,000 pounds. Calibration of our test machine is performed annually and was last calibrated in March 14, 2013.

Gauge pressure and the corresponding load were measured three times over the load range for the system. The results were averaged to determine a linear equation for the load in pounds versus the gauge pressure in psi. The results of the load verification are presented numerically in Table 1. The graph presenting load versus the gauge pressure is attached.

If you have any questions regarding this report, please feel free to contact us.

Respectfully submitted,

CTL | THOMPSON MATERIALS ENGINEERS, INC.

Daniel L. Barrett

Daniel L. Barrett
Materials Lab Manager

Reviewed By:

Damon B. Thomas, P.E.
Division Manager

DLB:DBT/dlb

1 copy sent
1 copy emailed: bryanl@midwestrockfall.com

This test report relates only to the items tested and shall not be reproduced, except in full, without written approval of CTL Thompson, Inc.

TABLE 1

LOAD VERIFICATION DATA FOR HYDRAULIC RAM SYSTEMS

Client: Midwest Rockfall, Inc.
Calibration Date: July 25, 2013
Ram ID: SPX Power Team 30 Ton S/N 1554949
Pump ID: SPX Power Team Electric # 9517
Gauge ID: SPX Power Team 2" 10,000 psi

Gauge Pressure (psi)	Average Load (lbs)
1,000	5,030
2,000	11,630
3,000	17,900
4,000	24,440
5,000	30,740
6,000	36,760
7,000	43,180
8,000	49,150
9,000	55,030

Project No. CT15565.003-435
Report Date: August 8, 2013

This test report relates only to the items tested and shall not be reproduced, except in full, without written approval of CTL Thompson, Inc.

HYDRAULIC RAM CALIBRATION

Client: Midwest Rockfall, Inc.
10401 E. 102nd Avenue
Unit 3
Henderson, Colorado, 80640
Attention: Bryan Love

Report Date: August 8, 2013
Calibration Date: July 25, 2013
Project Name: Ram Calibration

Project No. CT15565.003-435

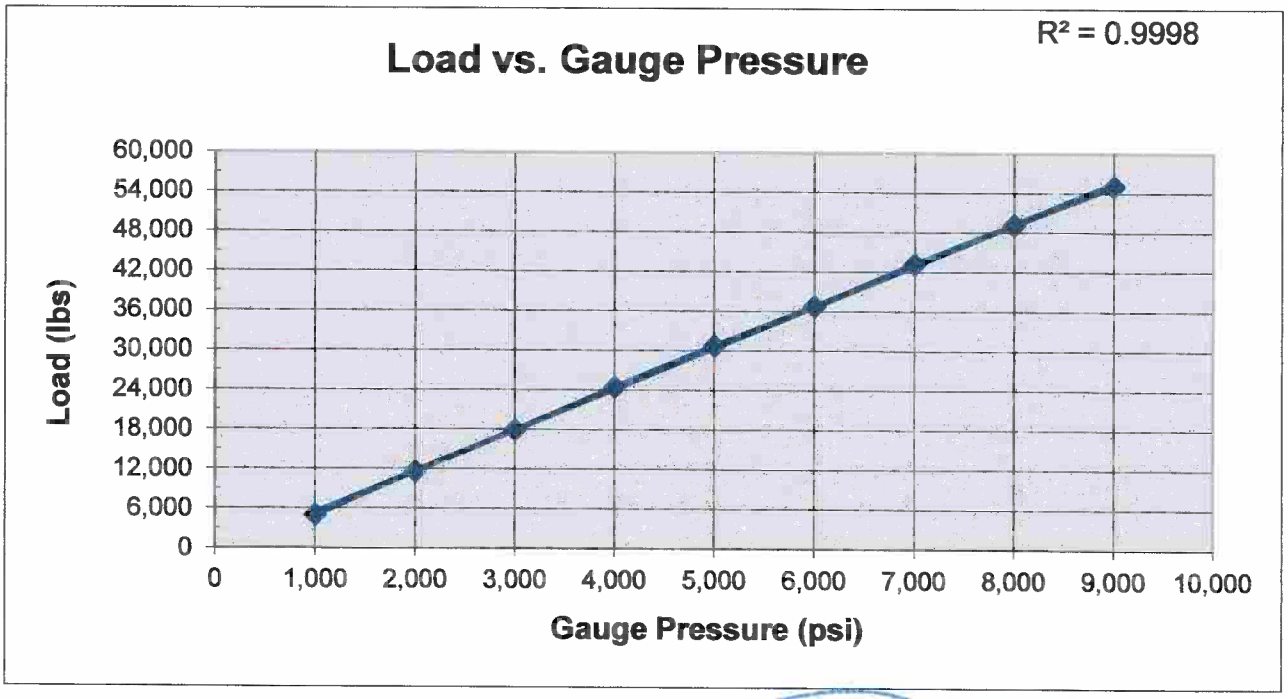
Ram ID: SPX Power Team 30 Ton S/N 1554949
Pump ID: SPX Power Team Electric # 9517
Gauge ID: SPX Power Team 2" 10,000 psi

Laboratory Equipment: Tinius Olsen 300K S/N 19962-CTO 191 Calibrated March 14, 2013

Equations

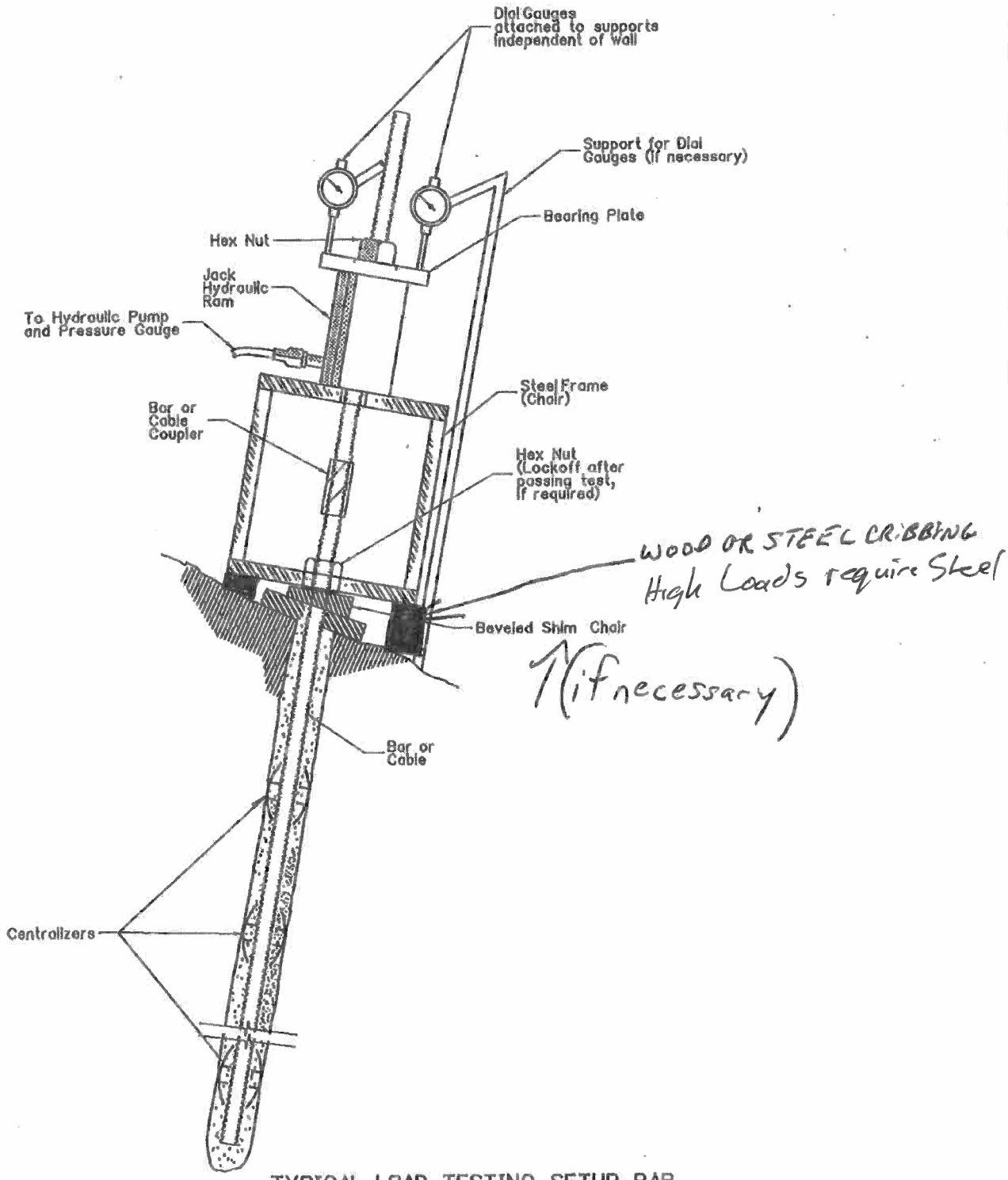
Gauge Pressure = 0.160 * Load +138

Load = 6.26 * Gauge Pressure -858



Damon B. Thomas, P.E.

This test report relates only to the items tested and shall not be reproduced, except in full, without written approval of CTL Thompson, Inc.



TYPICAL LOAD TESTING SETUP BAR

SPX

Power Team

P: Manual 1-Speed

RETURN TO PREVIOUS PAGE

PRODUCT TYPE
HAND/MANUAL

12 to 55 cu. in. Single-Speed, Single-Acting

Features

BEST SUITED FOR APPLICATIONS WHERE THERE IS LITTLE OR NO FREE TRAVEL.
All metal construction, won't burn through in welding environments.
Formed metal handle provides less flex, and reduces operator fatigue.
Convenient fill port on P23 and P55 allows pumps to be filled in a horizontal or vertical position.
Fill cap seal acts as safety valve preventing over-pressurizing of reservoir.
Relief valve inboard of check valve prevents loads from drifting down.
Large valve knob gives added control for slowly metering loads down.

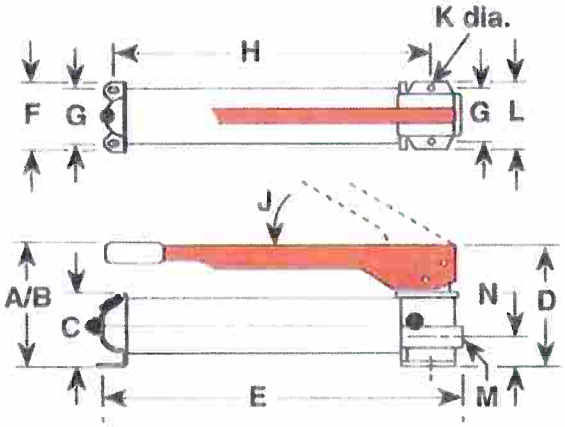
Power Team hand pumps, with the angled fill port, have a built in "relief valve" protection system. This system is designed to protect over-pressurization of the reservoir from sudden back pressure. This system also works as a seal to prevent oil leaks.

Specifications

Order No.	For Use With	Speed	Volume per Stroke (cu. in)		Maximum Pressure (psi)		Handle Effort (lbs.)	Reservoir		Oil Port (in.)	Weight (lbs.)
			LP	HP	LP	HP		Oil Cap. (cu. in.)	Usable Oil Cap. (cu. in.)		
P12	Single	1	—	0.069	—	10,000	75	12	9	3/8 NPTF	5.7
P23	Acting	1	—	0.16	—	3,000	70	23.8	20.3	3/8 NPTF	12.0
P55	Cylinders*	1	—	0.16	—	10,000	145	55	45	3/8 NPTF	15.8

* Pump includes 2-Way Valve
LP = Low Pressure
HP = High Pressure

Dimensions



Order No.	A (in.)	B (in.)	C (in.)	D (in.)	E (in.)	F (in.)	G (in.)
P12	4	13	2 1/16	4	13 1/2	3 3/8	2 3/16
P23*	6 1/4	13	3 1/2	5 9/16	13 5/8	4 1/4	3 1/4
P55	6 1/2	21	3 1/2	5 9/16	23	4 1/4	3 1/4

*The P23 pump maximum pressure is 3000 psi only.

Order No.	H (in.)	J (deg.)	K (in.)	L (in.)	M (in.)	N (in.)	P (in.)
P12	11 1/2	45	3/16	3 3/8	3/8 NPTF	1 1/8	—
P23*	10 5/16	38	3/16	4 3/4	3/8 NPTF	1 5/8	—

SPX

›Power Team

RH: 10-100T S/A

RETURN TO PREVIOUS PAGE

PRODUCT TYPE:
CENTER HOLE

Single-Acting, Spring-Return. Ideal for pulling and tensioning of cables, anchor bolts, forcing screws, etc.

Features

IDEAL FOR PULLING AND PRESSING.
Interchangeable piston head inserts provide versatility of application.
12, 20, 30, 60, 60 ton single-acting models feature threaded collar
Withstands full "dead-end" loads.
Corrosion resistant standpipe has "Power Tech" treatement
All cylinders except RH120 are furnished with a 9700 3/8" NPT female half coupler
Aluminum cylinder body and piston are featured on the RHA306 Cylinder
Model RH203 and RHA306 do not feature the collar thread. See charts in Specifications.

ASME B30.1 10,000 PSI

Specifications

Order No.	Cyl. Cap. (tons)	Stroke (in.)	Oil Cap. (cu. in.)	Mounting Holes and Bolt Circle (in.)	Cylinder Effective Area (sq. in.)	Internal Pressure at Cap. (psi)	Tons at 10,000 psi (in.)	Weight (lbs.)
RH102	10	2 1/2	5.52	1/4-20x2 3/8	2.21	9,054	11	9.0
RH108	10	8	17.68	1/4-20x2 3/8	2.21	9,054	11	18.7
RH120**	12	5/16	.87	5/16-18x2	2.76	8,692	13.8	3.0
RH121	12	1 5/8	4.49	None	2.76	8,692	13.8	6.6
RH121T*	12	1 5/8	4.49	None	2.76	8,692	13.8	6.6
RH123	12	3	8.29	None	2.76	8,692	13.8	8.9
RH202	20	2	9.45	3/8-16x3 1/4	4.72	8,466	23.6	16.1
RH203	20	3	11.76	3/8-16x3 1/4	3.92	10,186	19.6	20.0
RH206	20	6	28.35	3/8-16x3 1/4	4.72	8,466	23.6	30.2
RH302	30	2 1/2	15.85	7/16-20x3 5/8	6.34	9,457	31.7	25.6
RHA306	30	5 7/8	38.1	None	6.34	9,457	31.7	21.9
RH306	30	6	38.1	7/16-20x3 5/8	6.34	9,457	31.7	39.0
RH503	50	3	32.58	5/8-18x4 3/4	10.86	9,208	54.3	46.6
RH603*	60	3	37	1/2-13x5 1/8	12.31	9,750	61.6	60.0
RH606*	60	6	73.86	1/2-13x5 1/8	12.31	9,750	61.6	76.0
RH1003*	100	3	61.8	None	20.62	9,700	103.1	115.0

* Supplied with carrying handles.
** RH120 and RH121T do not have an internal threaded insert, but do have 3/4-16 internal thread. The RH120 inlet port is 1/4" NPTF.

Dimensions

Submittal 900.620

Rock Anchor Testing

Submittal 900.640

Rock Anchor

Paragraph 29.b,4

Work Plan

Manufacturer's certification/Mill sheets for Rock Anchors and associated hardware

To be supplied upon delivery of Materials

MIDWEST ROCKFALL, INC. **WORK PLAN**	Project No.: 0297(8)	Item Description: Rock Anchor
	Project Name: HighGate STP	Item No:
	Location: HighGate , VT	Quantity / Units 350LF
	Prepared By: Luke Fetzer	Date: 6/17/2013

Work Description	WORK PLANS
Rope Access Method	Workers will access the slope using the SPRAT method. Safety plan attached seperately
Rock Anchor Type and Calibration Data	Williams Form Engineering catalog cuts and Calabration Data attached seperatley
Mill Certification	Avalable when Material is dellivered to the project site
Rock Anchor Installation	Rock anchors will be installed using a Marini drill slide and a 4" Atlas Copco DTH. Once the hole is flushed clean of any debris workers will insert the anchor with centralizers and tremmie tube attached assuring the hole is free from obstructions. Next workers will attach the grout hose and begin grouting Type 1 Type 2 portland with a Chemgrout pressurized grout pump until hole is full and then fill the "birds beak" after initial grout has cured. During the erection of the gabion wall workers will attach couplings and threadbar to pertrude through the gabions and then attaching the bearing plates, nuts, and washers and then torquing the nuts to the required load

Work Description	Labor Type	QTY	Units	Units / Day	Total Days	Hours / Day	Days / Week	Reg. Hrs	O.T. Hrs	Total Hours
Rock Anchoring	Driller	LF	350	100	3.5	10	3.5	35	0	35
									TOTAL WORKING DAYS	4

Work Description	Equipment	QTY	Rental Period	Standby Hrs	Operating Hrs
Anchor Installation	Mini Excavator	1	0	10	40
Anchor Installation	375 CFM air compressor/ Marini Drill Slide	1	0	10	40
			0		

Quantity	Units	Material Description	ASTM / AASHTO
350	LF		Material Data Sheets Attached
		Grout	Separately
		Threaded Bar and Accessories	

Description	Reference	Quality Assurance	Additional Attachments
		Field Tested Anchors	
		Certificates of Conformance	

MWR FORM 505

Submittal 900.620

Rock Anchor Testing

Submittal 900.640

Rock Anchor

Paragraph 29.b, 5

Work Plan

Proposed Method of installation for rock anchors, including grout mixes and drilling methods

MIDWEST ROCKFALL, INC. **WORK PLAN**	Project No.: 0297(8)	Item Description: Rock Anchor
	Project Name: HighGate STP	Item No:
	Location: HighGate , VT	Quantity / Units 350LF
	Prepared By: Luke Fetzer	Date: 6/17/2013

Work Description	WORK PLANS
Rope Access Method	Workers will access the slope using the SPRAT method. Safety plan attached seperately
Rock Anchor Type and Calibration Data	Williams Form Engineering catalog cuts and Calabration Data attached seperatley
Mill Certification	Avalable when Material is dellivered to the project site
Rock Anchor Installation	Rock anchors will be installed using a Marini drill slide and a 4" Atlas Copco DTH. Once the hole is flushed clean of any debris workers will insert the anchor with centralizers and tremmie tube attached assuring the hole is free from obstructions. Next workers will attach the grout hose and begin grouting Type 1 Type 2 portland with a Chemgrout pressurized grout pump until hole is full and then fill the "birds beak" after initial grout has cured. During the erection of the gabion wall workers will attach couplings and threadbar to pertrude through the gabions and then attaching the bearing plates, nuts, and washers and then torquing the nuts to the required load

Work Description	Labor Type	QTY	Units	Units / Day	Total Days	Hours / Day	Days / Week	Reg. Hrs	O.T. Hrs	Total Hours
Rock Anchoring	Driller	LF	350	100	3.5	10	3.5	35	0	35
									TOTAL WORKING DAYS	4

Work Description	Equipment	QTY	Rental Period	Standby Hrs	Operating Hrs
Anchor Installation	Mini Excavator	1	0	10	40
Anchor Installation	375 CFM air compressor/ Marini Drill Slide	1	0	10	40
			0		

Quantity	Units	Material Description	ASTM / AASHTO
350	LF		Material Data Sheets Attached
		Grout	Separately
		Threaded Bar and Accessories	

Description	Reference	Quality Assurance	Additional Attachments
		Field Tested Anchors	
		Certificates of Conformance	

MWR FORM 505

MIDWEST ROCKFALL, INC

10401 E 102nd ave
Henderson, CO 80640
p 303.288.4970
f 303.288.4986

August 14, 2013

Highgate STP 0297(8)

To:
Chris Belanger
ECI
From:
Luke Fetzer
MWR Project Manager
10401 East 102nd Avenue
Henderson, CO 80640
303-288-4970
Fax: 303-288-4970

MWR Project Manager

Mr. Belanger,

This letter is to inform you that Midwest Rockfall Inc. will be using a Marini Drill to perform the work under the above mentioned project. Due to the nature of limited access on many of our projects and this project the Marini drill slide will work efficiently given the space provided. Attached is the manual for the machine and photos of the drill successfully drilling anchors in very difficult geological conditions. Due to varying site conditions it is necessary to custom fabricate attachments for the drill slide to be fixed to. After verifying the measurements during a site visit the drilling setup we wish to use will have ample room to perform the work.

Luke Fetzer,

Job Name: _____

Contract #: _____

Contractor Rep: _____

Owner Rep: _____

Midwest Rockfall, Inc.

Proof Test & Bore Logs

Location	Total Length	Unbonded	PSI Guage at 1 Min.	PSI Guage at 10 Min.	Grout Volume	Date Drilled	Date Grouted	Date Tested	Drill Hole Description
R26									
R27									
R28									
R29									
R30									
R31									
R32									
R33									
R34									
R35									
R36									
R37									
R38									
R39									
R40									
R41									
R42									
R43									
R44									
R45									
R46									
R47									
R48									
R49									
R50									

MIDWEST ROCKFALL, INC

10401 E 102nd ave
Henderson, CO 80640
p 303.288.4970
f 303.288.4986

August 15, 2013

Highgate STP 0297(8)

To:
Chris Belanger
ECI
From:
Luke Fetzer
MWR Project Manager
10401 East 102nd Avenue
Henderson, CO 80640
303-288-4970
Fax: 303-288-4970

MWR Project Manager

Mr. Belanger,

This letter is to inform you that Midwest Rockfall Inc. proposes a mix design of 5 gallons of potable water per bag of Iron Clad Type II cement grout.

Luke Fetzer,

IRON CLAD TYPE II

- Complies with all standard chemical and physical requirements for Types I and II cement contained in American Society for Testing and Materials (ASTM) C-150, "Standard Specification for Portland Cement"
- Will provide strong, durable, long lasting concrete when combined with ASTM approved materials and used according to American Concrete Institute (ACI) recommended practices
- Will provide Type N, S, or M masonry mortar when used in accordance with ASTM C-270, "Standard Specification for Mortar for Unit Masonry"
- Sold in bulk or convenient one cubic foot (94lb.) bags
- Is darker gray in color than IRON CLAD Type I cement
- Recommended for use in general concrete construction, masonry mortars, warm weather construction, and special applications where lower heat of hydration and increased sulfate resistance are required

IRON CLAD

PORTLAND CEMENT

LEHIGH NORTHEAST CEMENT COMPANY

CAT
375
Rentals

MARINI QUARRIES GROUP

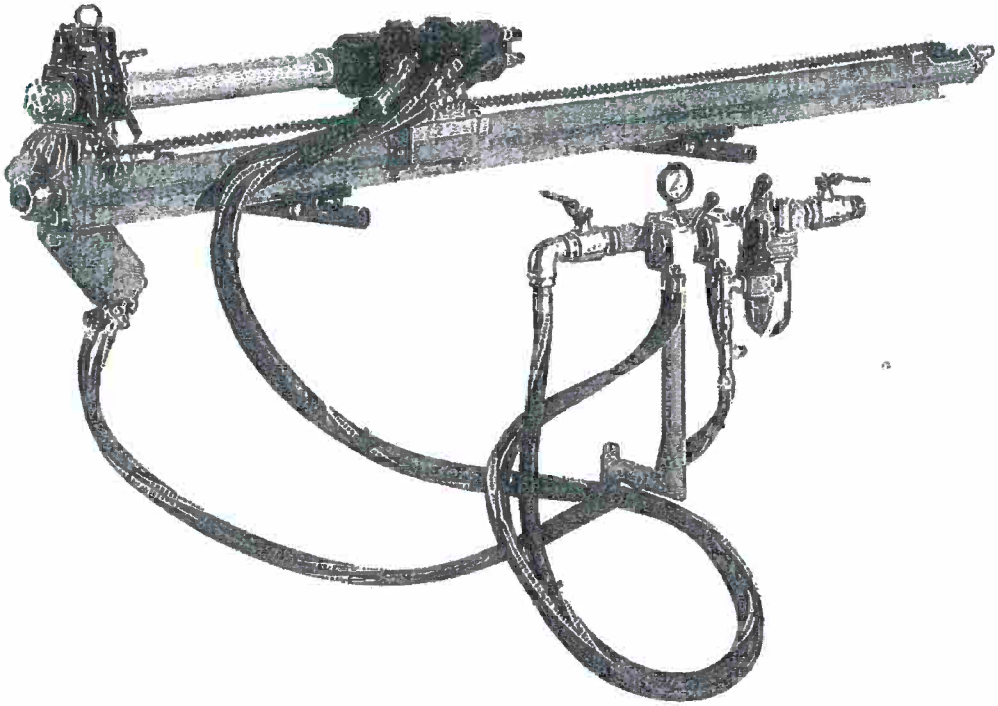
MCDP

PERFORAZIONE

DRILLING

USE AND MAINTENANCE MANUAL

MARINI QUARRIES GROUP S.R.L.
Via Beura, 44 • 28844 Villadossola (VB) • ITALY
Tel.: +39 0324 575106 • Fax: +39 0324 54096
Web : www.marinlqg.it
E-mail: MarinlQG@MarinlQG.it



Dear Sir,

Thank you for choosing our drill

MCDP

We guarantee you that you purchased a quality product

We prepared this manual for your better knowledge of the features of this model.

Through the following pages you can find some advice

for the recommended utilization of your machine.

We are confident that in this way you can use it for a long time with full satisfaction.

Kind regards

Marini Quarries Group

WARNING

This manual contains important information on safety.
Before carrying out any handling or utilization operation accurately consult this utilization and maintenance manual.

This manual contains copyright reserved information.
All rights reserved.

Any form of reproduction, adaptation, or translation without the previous written consent of Marini Quarries Group is forbidden.

Marini Quarries Group is not liable for direct or indirect damages to persons or things due to the use of this manual or machine in conditions different than those prescribed or which do not guarantee the operators' safety.

All data contained in this manual are indicative and not binding, given that Marini Quarries Group reserves the right to modify or vary its machines without any previous warning.

INDEX

INDEX 4
PRESENTATION 5
GENERAL INFORMATION 5
Manual content and use 5
Typographical convention 5
Guarantee 6
Modifications to the machine 6
Machine identification 6
Identification of spare parts 6
General information concerning safety 7
Safety prescriptions 7
RISKS HIGHLIGHTED BY THE ANALYSIS OF DANGERS AND DANGEROUS SITUATIONS DURING THE WORK 8
PREVENTIONS MEASURES AND INSTRUCTIONS FOR MACHINES OPERATORS 8
INDIVIDUAL PROTECTION DEVICES 8
HANDLING AND TRANSPORTATION 9
AIR CONNECTIONS 10
VERIFICATIONS AND ADJUSTMENT 11
USING THE MACHINE 12
EXTENSION ROD JOINTING 14
ROD AND HAMMER RECOVERING 15
MAINTENANCE 16
PLATE I 17
PLATE II 18
PLATE III 19
EXPLODED DIAGRAMS AND SPARE PARTS LIST 21

PRESENTATION

The MCDP drilling slide is extremely light and handy drilling unit.They can be equipped with a pneumatic rotating head (for using 2" and 3" down the hole hammer), with a rock drill weighting 58 Kg with separate right and left rotation or with a rotopercussion pneumatic rock drill up tp 30 Kg.

A special down jack allows it to be anchored on rock.Two plates with a special quick fixing anchorage, allow to use it on tubular structure scaffolds or in other special operations.

The MCDP slide is equipped with a pneumatic piston motor for feeding,which supplies a tractive force of 8340 N (850 Kg) .

The MCDP slide in its standard versions is suitable for using 1,0 m. or 1,5 m. rods.

GENERAL INFORMATION

Manual content and use

Keep this manual in a dry and safe place for future reference, so that it is not ruined and is always available for consultation.

This manual cannot replace the user's experience but it does supply all the information for correct machine use.

If you need copies or up-dates, exclusively contact the Marini Quarries Group, which will supply indications on the matter and solve any problems.

Typographical convention

The notes supply suggestions or special tips.

This message informs the user about incorrect procedures or special conditions which may damage the machine or place the operator in danger.

GENERAL NOTES ON DELIVERY

On receipt of the machine, open the package and check that:

- the equipment is not damaged
- in the case of transport damage, inform the forwarder and / or the transport insurance company in a detailed way, immediately on delivery.
- the supply corresponds to the order specifications

If any pieces are missing, immediately inform the Marini Quarries Group within 8 days of receipt.

Guarantee

The machine is supplied and guaranteed to be free from fabrication faults or defective material for a period of 12 months from the date on the transport document. This guarantee is valid only if any parts found to be defective are reported to the Marini Quarries Group within 8 days from arising.

Parts proved to be defective will be retired or replaced, at the discretion of the Marini Quarries Group, on condition that the said defect does not depend on failure to observe the use and maintenance instructions, bad or unsuitable use of the equipment or on normal wear.

The parts to be replaced or repaired will be made available ex-our workshop.

The user shall sustain the shipment and transport costs, plus those for the labour, travel and board, if the repair should necessitate the presence of one of our technicians.

Parts subject to wear are not covered by the guarantee.

Modifications to the machine

Marini Quarries Group reserves the right to make all necessary modifications to the machines it manufactures without any prior notice.

Machine identification

The machine is identified by the no. indicated on the card (see 'Technical description' on page 8).

Identification of spare parts

When requesting spare parts, always indicate the machine's serial number found on the test card and the no. of the required part taken from the enclosed lists of spares.

S A F E T Y

General information concerning safety

The design and manufacturing of this machine adopted the criteria and measures adequate to comply with the essential safety requirements provided for by the 89/392/CEE European regulation and successive modifications (91/368/CEE - 93/44/CEE - 93/68/CEE).

In particular, measures designed to prevent risks to operators were adopted during the design and construction phases.

The complete documentation of the safety measures adopted is contained in the technical dossier deposited at the offices of the Marini Quarries Group Srl.

For some risks it was not possible to find solutions at the design level. In that case, in this manual the safety prescription to comply with to operate in the safest way are indicated.

WARNING: Marini Quarries Group recommends complying with the instructions, procedures and recommendations of this manual, to adopt all precautions suggested by the technique and to comply with the accident prevention rules in force.

Safety prescriptions

- The installation, maintenance, and utilization of the machine is reserved to specialized staff.
- Before making any cleaning or maintenance intervention verify having disconnected the power supply.
- Do not remove the fixed protections of the machine protecting the mobile elements.
- Do not put the hands in the parts where there is danger of crushing and/or trapping.
- The operator should stay by the controls group in the most distant and protected position.
- The make and control the working operations the operator has to position himself always behind the controls group.
- The handling of the machine or part of it has to be made with the machine idle, the power supply disconnected, by specialized staff with the appropriate tools.
- If it is necessary to replace the machine components, use original spare parts exclusively.

NOISE EMISSION

WARNING: The operator must be provided with adequate acoustic protection.

RISKS HIGHLIGHTED BY THE ANALYSIS OF DANGERS AND DANGEROUS SITUATIONS DURING THE WORK

Contact with aerial electrical lines, shocks, blows, impacts, compressions, vibrations, slipping, fall at grade, noise, shearing, grinding, fall of material from height, mineral oils and derivatives.

PREVENTIONS MEASURES AND INSTRUCTIONS FOR MACHINES OPERATORS

Before utilization:

- Verify that all the bolts of the machine are adequately screwed;
- Verify the absence of aerial electrical lines which can interfere with the machine operating range;
- Check the tracks and operating areas preparing all bracing structures;
- Efficiently stabilize the machine;
- Verify the efficiency of the blocking systems and ground machine clamping;
- Signal the operating area exposed to high noise levels;
- Limit the area around the machine to avoid entrance of unauthorized persons.

During utilization:

- Report immediately any inappropriate functioning or dangerous situations;
- The operator's position needs to be such as not to be in contact with the parts in movement;
- Do not intervene on mobile parts during the functioning of the machine;
- Do not get distracted.

After utilization:

- remove the air supply to the machine
- correctly position the machine without leaving the tool suspended;
- stop the translation carriage;
- carry out the review and maintenance operations needed to reuse the machine with the power supply disconnected;
- in the maintenance operations comply with the indications of this manual.

INDIVIDUAL PROTECTION DEVICES

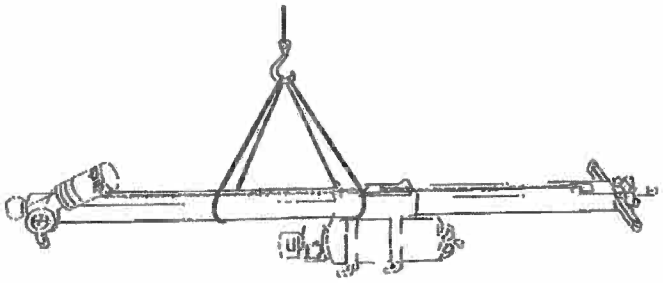
The operator should wear:

- accident prevention shoes
- protection helmet
- protection glasses
- gloves
- auricular earphones
- it is suggested to wear padded clothes

HANDLING AND TRANSPORTATION

WARNING: the handling and transportation of the machine should be carried out by specialized or adequately trained staff with the support of the adequate lifting equipment.

Figure 2a



HORIZONTAL LIFTING

Slide and rotating head weight	95 kg. (211 Lb)
Hammer and bit weight	30 kg. (66 Lb)
Control panel weight	33 kg. (73 Lb)

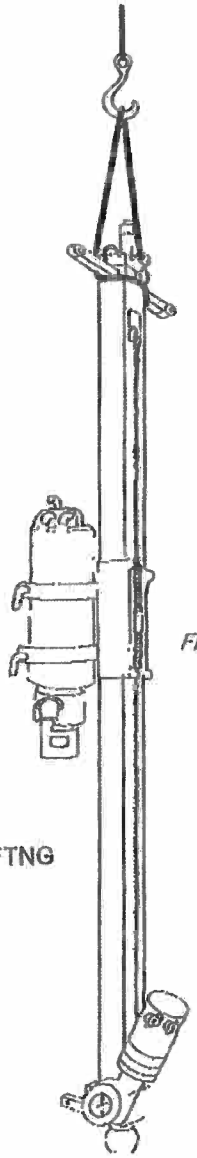


Figure 2B

VERTICAL LIFTNG

AIR CONNECTIONS

(For references see PLATES I, II, III on PAGES 21/22/23)

1. Position the control panel at a suitably safe distance.
2. Direct the control panel to the most suitable and safe position for performing the operations.
3. Close the compressor 12 (Plate III) entry valve and the supply valve for the down the hole hammer 13 (Plate III) as in fig.6
4. Connect the feeding hose 14 (Plate III) of the down the hole hammer to the corresponding fitting on the output group of the rotating head 6 (Plate I).

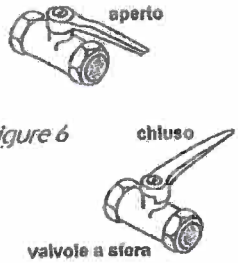
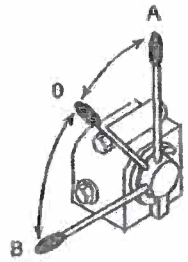


Figure 6

5. Connect the head rotation feeding hoses 15 (Plate III) - right and left - to their corresponding fittings 8 (Plate I) on the rotating head, paying attention to match the black marks with the black marks of the rapid fittings.
6. Connect the up and down hoses 16 (Plate III) to the corresponding fittings 10 (Plate I) on the advance motor, paying attention to match the red marks with the red marks of the rapid fittings.
7. Position the distribution levers for rotation 1 (Plate III) and advance 2 (Plate III) to closed or rest (central position) 0 (zero).

Figure 7



Rotation distributo and advance distributor

ROTATION	ADVANCE	
A. anticlockwise (rod unscrewing)	A.	up (backwards)
0. rest	0.	rest
B. clockwise (drilling)	B.	down

Observe the three positions shown in fig.7

8. Connect the main feeding hose 17 (Plate III) of the supply compressor to the corresponding valve 12 (Plate III) on the control panel.

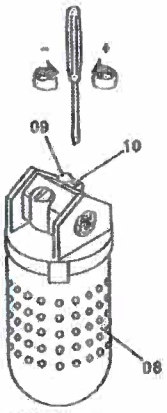
For the air supply, use a hose no smaller than 1" 1/4

VERIFICATIONS AND ADJUSTMENT

WARNING: with the new machine and after a long period of idleness pour oil directly in the supply pipes of the drills, for a most rapid initial lubrication.

Figure 8
Gauge on control panel

- Check that there is a sufficient amount of lubricating oil in the tank 8 (Plate III and fig.9) of the lubricator. If not consult page 20 – maintenance: adding oil.
- Make certain that the compressor supplies enough pressure to position the gauge needle 3 (Plate III) in the green field of the dial (fig.8) corresponding to 5.5 ÷ 7 bar.
  (If this is not the case see page 24 – problem solving suggestions)



WARNING: this pressure should be kept constantly in the green area during the drill (ideal pressure 6 bar).

- Regulate the passage of the correct amount of oil using the adjustment screw 10 (Plate III and fig.9) and look into the visualizer 9 until you see one drop of oil fall every two seconds. This is the correct adjustment.
- A practical control for a correct lubrication can be made disconnecting the supply pipe of the drill and supplying air as if it should be fed. With the air jet directed on the palm of the hand it should be slightly oily.

NOTE: Screwing up the regulation screw reduces the passage of oil, unscrewing it increases it

WARNING: to perform this operation, it is necessary to open the air gradually, keeping the hose well anchored.

USING THE MACHINE

WARNING: before using the machine, check that it is well anchored to the ground and that all the bolts and air hoses are correctly tightened.

Fitting the down the hole hammer (DTH)

The machine is generally supplied with the down the hole hammer fitted to the rotating head.

The same hammer, has the drilling bit fitted to its bottom end. The type of bit is the one requested by the customer, or the most suitable one for the material to be drilld.

To fit a down the hole hammer not supplied with the machine, strictly follow the instructions of the company that supplied the hammer.

The down the hole hammer is screwed on in a clockwise direction to the output group of the rotating head. Before fitting, make sure that the threaded fitting is the same as the one on the rotating head: cylindrical RD50 or API Regular 2" 3/8 conical.

The down the hole hammer must be tightened with the special wrenchs supplied (see 'Extension rod joint' page 17).

Using the machine

(For references see PLATE III page 28)

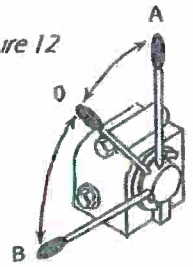
1. Supply the control panel by opening the valve 12 (Plate III) .

Figure 11
Gauge

2. Check that the gauge needle 3 (Plate III) oscillates within the green field on the dial (fig.11).

3. Approach the hammer bit to the surface to be drilld. This is performed by lowering the distribution lever 2 (Plate III) towards position B of fig.12. The distributor commands the advance of the rotating head - down the hole hammer group.

Figure 12



Head rotation distributor
Pos.1 Plate III
Dadvance distributor
Pos.2 Plate III

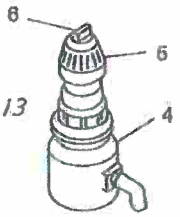
USING THE MACHINE

4. Open the valve 13 and rotate and percuss the hammer by lowering distribution lever 1 (Plate III) towards position B of fig.12. The hammer bit rotates clockwise.
   Release the stopper 6 on the pressure regulation 5 (fig.13) by unscrewing it anti-clockwise.

5. Regulate the head rotation using the pressure regulator 4 by screwing and/or unscrewing the knob 5 (fig.13).

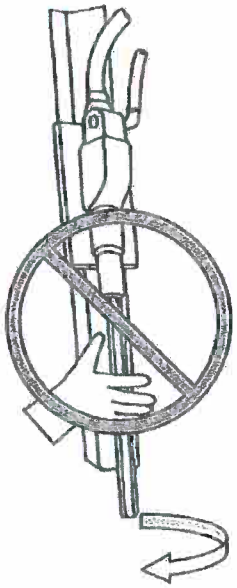
6. Drilling has now started.

Figure 13



Pressure regulator
Pos.4 Plate III

WARNING: advance only serves to keep the bit close to the rock to be drilld, and not to keep it pressed against the rock itself.



WARNING

TOUCHING THE HAMMER OR THE RODS DURING HEAD ROTATION IS FORBIDDEN

DANGER OF ENTRAPMENT OR CRUSHING

WARNING: Anchoring at a height (projecting) is only permitted if the operator is positioned in a stable manner on suitable scaffolding.

EXTENSION ROD JOINTING

At the end of the drilling limit:

1. Block the advance, rotation and percussion by closing the respective distributors 1 and 2 Plate (pos.0 "rest" fig.7 and fig. 12) and valve 13 Plate III.
2. Recover the play of the carriage springs 3 (Plate I) by slightly lifting up the rotating head (fig.14 and fig.15).
3. Insert the wrench supplied into the seat (a) of the output group and turn it against the column. This prevents the reducer from advancing and the rotating head from becoming damaged by counter-blows while changing the rods. (fig.16).
4. Insert the wrench supplied into the seat (b) of the hammer or rod and keeping the wrench contrasted in (a) against the column, release the hammer or rod by applying a few hammer blows to the wrench in the seat (b) (fig.16).
5. Remove the wrenchs, rotate the rotating head in an anticlockwise direction (pos.A of distributor 1 - fig.7 page 16) and unscrew the hammer or the rod. Position the rotating head high on the column, almost as far as it will go.
6. Manually screw the extension rod onto the hammer or possibly onto the other rod found in the hole (fig.17).
7. Advance the rotation head and make it rotate clockwise (pos.B of distributor 1 - fig.7 pag.16) and screw it to the rod or the hammer.
8. After checking that the rod has been screwed both to the head and the hammer (or possibly to the other rod still found in the drill), start drilling again.

For more joints, repeat the operations described.

Figure 14

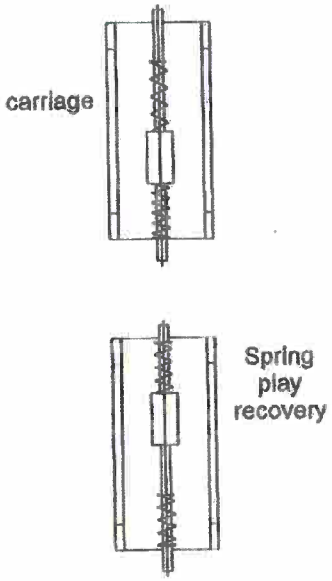


Figura 15

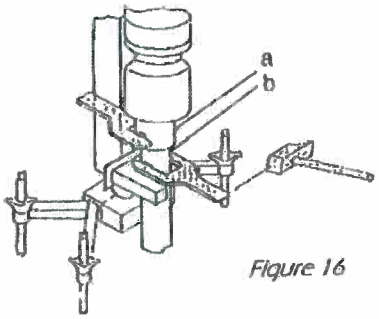


Figure 16

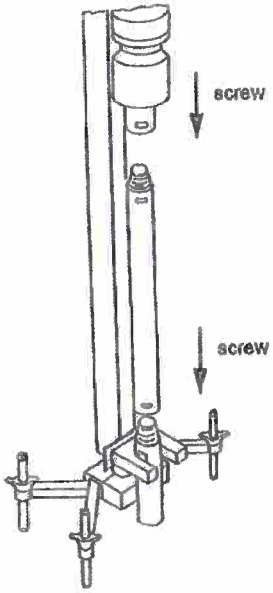


Figure 17

WARNING: never unscrew the rods or the hammer with just the force of the rotation head. Keep the control panel as far away as possible from the column to prevent accidental manouvres

ROD AND HAMMER RECOVERING

1. Block the advance, rotation and percussion by closing the respective distributors and valve 2, 1, 13 Plate III.
2. Position the rotating head high on the column almost as far as it will go.
3. Insert the wrench supplied into the seat (d) of the rod which finds itself in the hole and make it rest on the rod guide. In the case of vertical drilling, this wrench serves to prevent the rods from falling into the drill at the moment they are unscrewed from the rotating head.
4. Insert the wrench supplied into the seat (a) on the rotating head and wedge it against the column.
5. Insert the wrench supplied into the seat (b)
6. Hit the wrench inserted in seat (b) with a hammer and release the rod, by making it rotate in a clockwise direction.

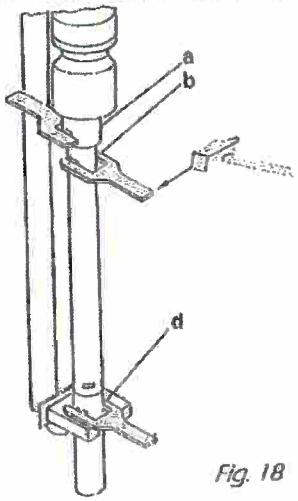


Fig. 18

NOTE: the wedged wrench serves to prevent the rotating head from suffering damage during rod or hammer removal

7. Remove the wrenchs from seats (a) and (b), rotate the head and unscrew it from the rod.
8. Position the rotating head high up on the column to almost as far as it will go.
9. Insert the wrench into seat (c), wedge the wrench in seat (d) against the column; hit the wrench in seat (c) with a hammer to release the rod and then unscrew it.

   We have now removed the 1st rod.
10. Approach the rotation head of the 2nd rod which is still found in the drill.
11. Screw the head to the rod to then make it rise up pulling the rod with it.

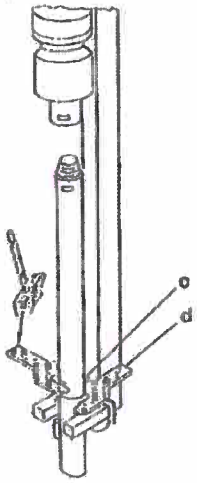


Fig 19

12. By repeating the procedure described, we recover the other rods and the hammer.

WARNING: never try to unscrew the rods or the hammer with the force of the rotation head alone. Keep the control panel as far away from the column as possible with the purpose of avoiding any accidental manouvres

MAINTENANCE

ADDING OIL

WARNING: before proceeding with the oil addition operations, stop the machine, close the compressor air supply and discharge any air remaining in the control panel by opening valve 13 Plate III. This is important because it is dangerous to remove the plug or the lubricator tank with the control panel under pressure.

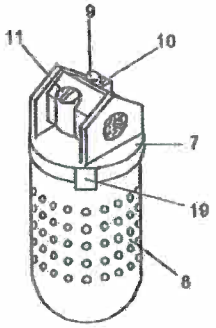


Figure 20

To add oil to the line lubricator, with the machine at a standstill and not powered up, unscrew the screw plug 11 (Fig.20) and add oil, or directly release the tank by pressing button 19 and by rotating the lock ring.

If the long idle periods are foreseen, or if the machine is made to operate after being idle for a long time, pour oil directly into the supply inlets of the rotating head and the advance motor and rotate them slowly for a few turns to lubricate the mechanical parts well.

Oil to use: MOBIL ALMO 525 or SHELL TORCULA 100.
If these are not available, use an equivalent oil, or anyway one which is rather fluid.

Grease to use: ROL-OIL ALCOPLEX 2 or equivalent

Periodical controls:

Daily: check the oil level in the line lubricator

check that all the bolts and the air hoses are suitably tightened

check the chain tension and adjust it with the tightener 14 (Plate I) if necessary check the integrity and wear of the bit.

Weekly: grease the chain pinion 2 (Plate I) of the advance group using the greasers provided (Part. A Plate I). Use the recommended grease or an equivalent one.

Check that the neck of the sphere is free from cracks. If you notice any cracks, suspend machine use.

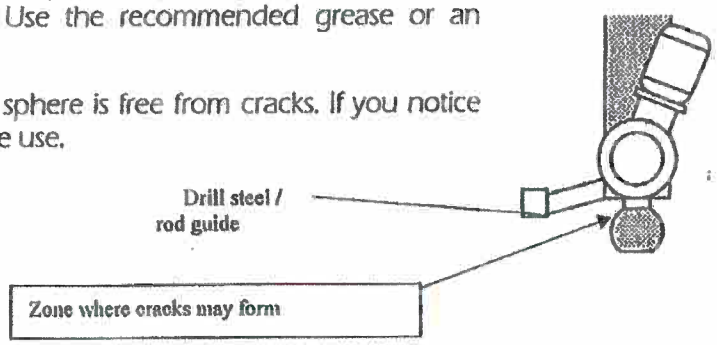
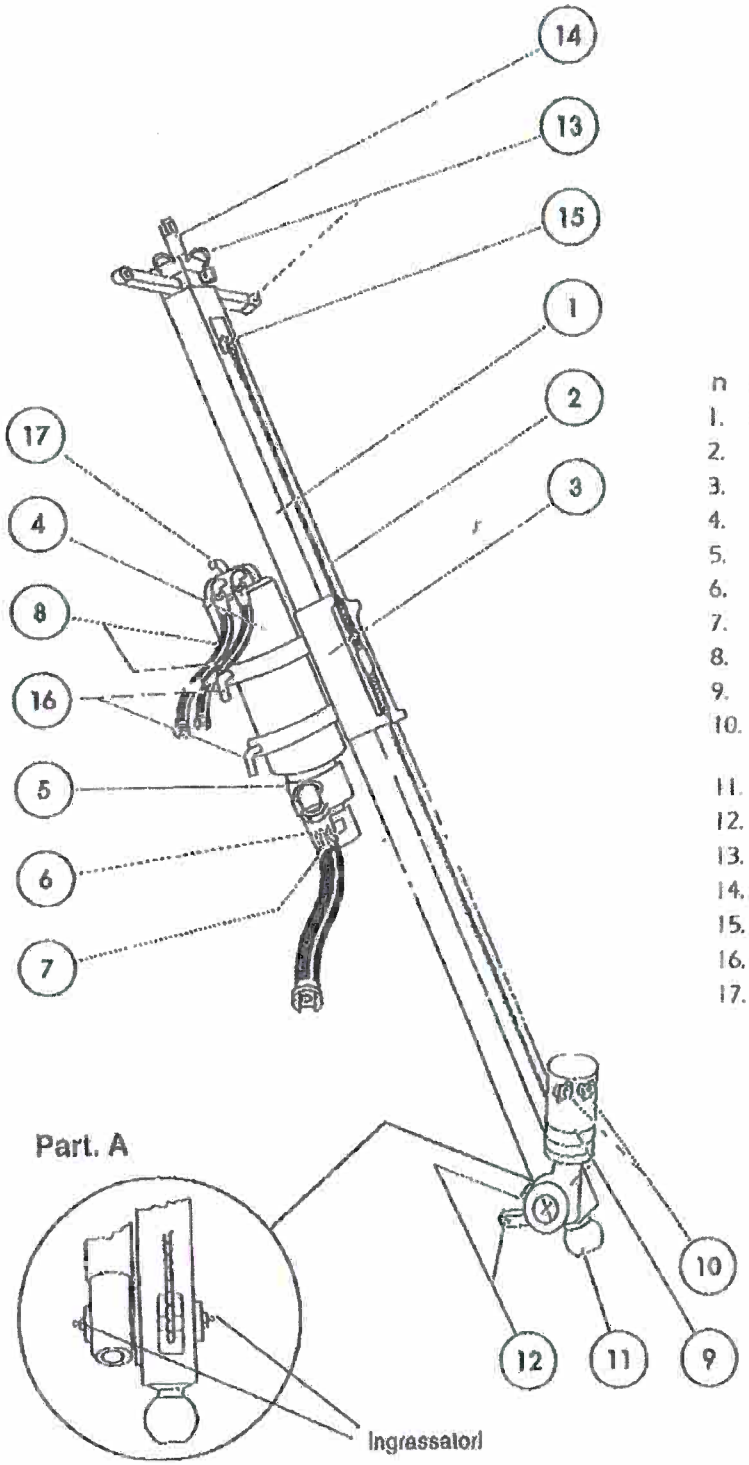


PLATE I

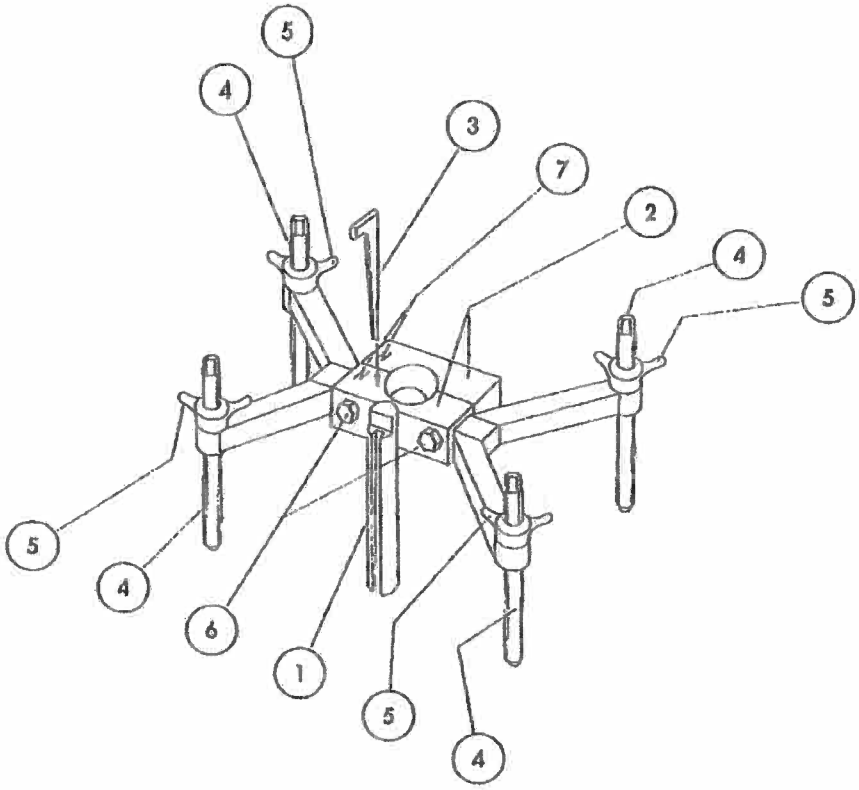
OVERVIEW



REFERENCES

n	description
1.	Support column
2.	Advance chain
3.	Carriage
4.	Rotating head
5.	Rotating head output group
6.	Hammer feeding hose
7.	Hammer or rod fitting seat
8.	Rotating head feeding hoses
9.	Advance motor
10.	Fast fittings of advance motor feeding hoses
11.	Spherical joint
12.	Rod guides
13.	Arms for levelling screws
14.	Chain tightener
15.	Chain transmission
16.	Head rapid release pins
17.	Air discharge

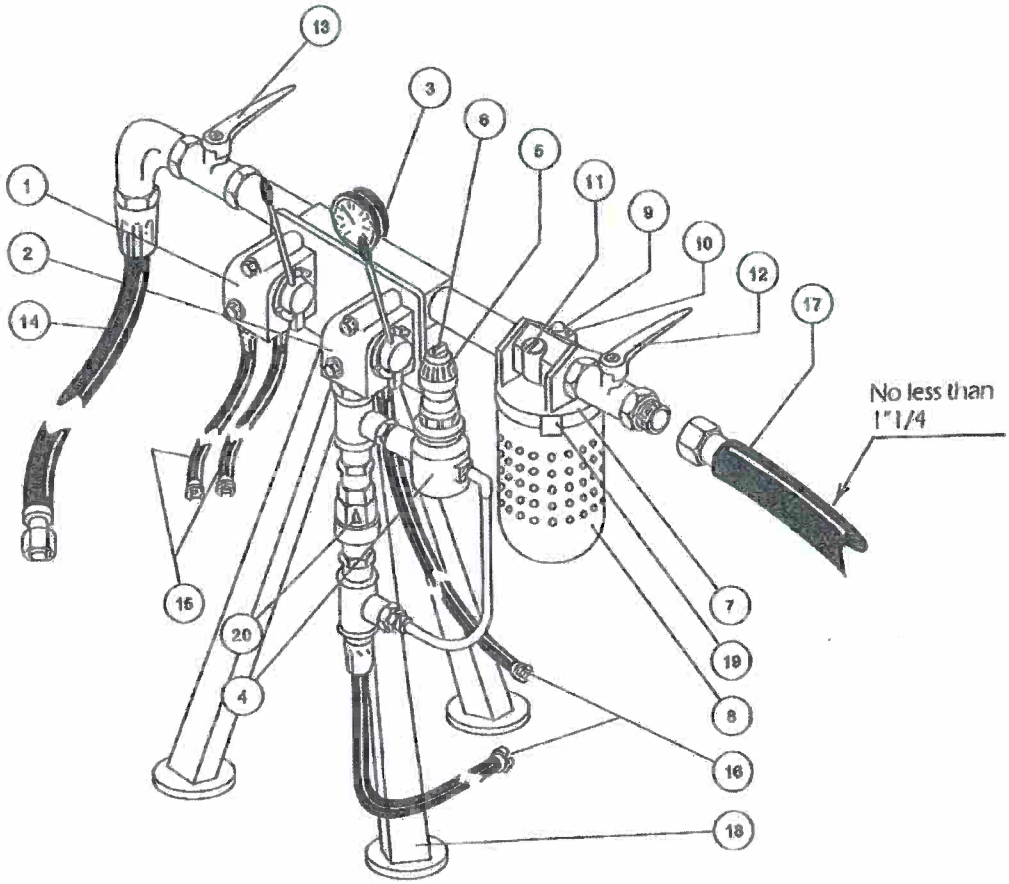
PLATE II
ANCHORING DOWN JACK
(OPTIONAL)



REFERENCES

n	description
1.	Grooved pin
2.	Spherical half-shell
3.	Conical fixing pin
4.	Levelling screws
5.	Lock nuts (wing nuts)
6.	Locking bolts
7.	Reference numbers

PLATE III
CONTROL PANEL



REFERENCES

n description
1. Rotating head distributor
2. Advance distributor
3. Gauge
4. Pressure regulator
5. Advance speed adjustment knob
6. Stop for blocking the rotation head advance speed
7. Line lubricator
8. Lubrication oil tank
9. Correct lubrication visualizer
10. Lubrication regulation screw
11. Screw plug for oil filling
12. Air supply from compressor valve
13. Air supply valve for down the hole hammer
14. Down the hole hammer feeding hose
15. Rotating head feeding hose
16. Advance feeding hoses
17. General feeding hose (from the compressor – no less than 1"1/4)
18. Control panel support (tripod)
19. Rapid release buttons for lubrication oil tank
20. Retaining valve

PROBLEM SOLUTION SUGGESTIONS

PROBLEM	CAUSE	SOLUTION
Insufficient air pressure (needle below the green field of the gauge).	Quantity of air generated by the compressor insufficient.	Replace the compressor with one with a higher yield (air delivery rate).
	Small feeding hose section or excessive feeding hose length.	Replace the feeding hose with one with a greater section and in proportion to the length. We advise using a hose no less than 1"1/4
Low yield	No lubrication	Check the lubrication of the down the hole hammer.
	Operating pressure insufficient.	As above
	Down the hole hammer worn, worn out or dirty.	Clean the down the hole hammer. Overhaul the down the hole hammer
	Worn bit.	Sharpen the teeth
Advance cannot be regulated by the pressure regulator	Faulty pressure regulator.	Change the pressure regulator (Plate III)
	Retaining valve pos.20 (Plate III) fault	Change the retaining valve 20 (Plate III).
	Advance feeding hoses inverted pos.16 (Plate III)	Invert the advance feeding hoses 16 (Plate III).
The advance motor does not turn.	No lubrication	Check the lubrication
	Foreign material has entered the blade rotation group.	Remove the motor upper cap and clean. Check that the rotor and blades move freely
The rotating head does not turn	No lubrication	Check the lubrication
	Seizure of the piston of the motor due to insufficient lubrication.	Replace the piston. We also recommend using the condensation separator.
	Motor piston breakage due to the entry of water into the air hoses.	
	Rotating distribution valve seized due to insufficient lubrication or because of the entry of foreign objects (e.g. earth) into the air hoses.	Replace the rotating valve.
	Reduction gear breakage due to incorrect rod jointing or unscrewing actions without the correct use of the wrenchs supplied.	Replace the reduction gear.
	Crushed rotation group due to the accidental falling of the column.	Replace the rotating head.
	Piston motor breakage, due to exceeding the maximum air pressure limit permitted: 6 bar.	Replace the pistons and other possibly damaged mechanisms. Change the compressor with one with low pressure or use a control panel with a pressure reducer.

EXPLODED DIAGRAMS AND SPARE PARTS LIST

Plate 1	colonna/column
Plate 2	puntone di ancoraggio/down-jack
Plate 3	gruppo comandi/control panel
Plate 4	motore a pistoni testa di rotazione/piston motor rotating head
Plate 5	Riduttore completo testa di rotazione/reduction gear rotating head
Plate 6	gruppo uscita testa di rotazione/connecting group rotating head
Plate 7	Motoriduttore avanzamento testa/ pneumatic motor reduction gear
Plate 8	riduttore di avanzamento/reduction gear (feeding)

PLATE 1
COLONNA / COLUMN

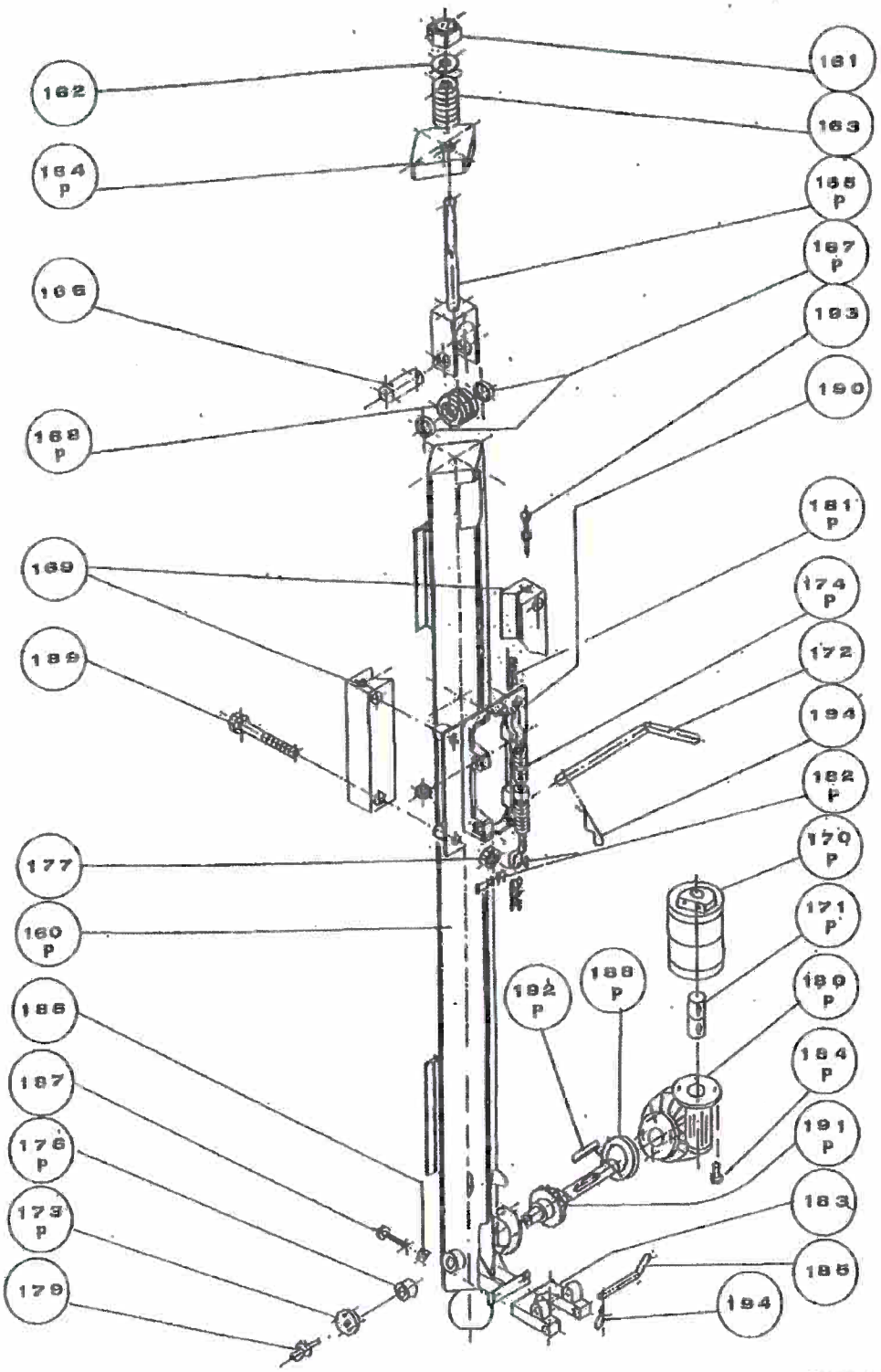


PLATE 1
COLONNA / COLUMN

Code	Pos.	Q.ty	Descrizione	Description
22-01	0160AP	1	Colonna 1100	Column stroke 1100
22-01	0160BP	1	Colonna 1600	Column stroke 1600
22-01	0161	1	Dado autobloccante M20	Self-locking nut M20
22-01	0162	1	Rondella A21	Washer A21
22-01	0163	1	Molla per tenditore	Tightener spring
22-01	0164P	1	Coperclo per colonna	Column cap
22-01	0165AP	1	Tenditore per catena completo	Complete chain tightener
22-01	0165P	1	Tenditore per catena 1"	Chain tightener
22-01	0166P	1	Perno per cuscinetti	Bearing pin
22-01	0167P	2	Cuscinetti	Bearing
22-01	0168P	1	Rinvio catena	Chain transmission
22-01	0169	2	Pattini discorrimento	Guide shoe
22-01	0170AP	1	Motore a pistoni da 2,5 HP	2,5HP piston motor
22-01	0170BP	1	Motore a pistoni da 3,5 HP	3,5HP piston motor
22-01	0171P	1	Perno di collegamento	Joint pin
22-01	0172	1	Spina	Spline
22-01	0173P	1	Coperchio	Cap
22-01	0174P	1	Ammortizzatore per catena da 1"	1" chain shock absorber
22-01	0176P	1	Bronzina	Bushing
22-01	0177	4	Dado autobloccante M20	Self-locking nut M20
22-01	0178P	1	Gruppo avanzamento MCDP completo di albero e pignone	MCDP feed group complete with shaft and sprocket wheel
22-01	0179	4	Ingrassatore	Grease nipple
22-01	0180P	1	Riduttore	Reduction gear
22-01	0181P	1	Catena da 1"	1" chain
22-01	0182	2	Giunto per catena	Chain joint
22-01	0183	1	Guida aste	Rod guide
22-01	0184	3	Vite TCM10	Screw TCM10
22-01	0184P	5	Vite M10	Screw M10
22-01	0185	1	Spina	Spline
22-01	0186	2	Dado M16	Nut M16
22-01	0187	2	Vite TE M16	Screw TE M16
22-01	0188P	1	Distanziale	Spacer
22-01	0189	4	Viti di fissaggio lardoni	Guide shoes fixing screw
22-01	0190	1	Carrello in avional	Avional trolley
22-01	0191P	1	Albero completo di pignone da 1"	Shaft complete with 1" sprocket wheel
22-01	0192P	1	Chiavetta per albero	Shaft key
22-01	0193	4	Registri per lardoni	Guide shoes adjusting screw
22-01	0194	2	Fermi per perni	Pin retainer

PLATE 2
Puntone di ancoraggio / Down jack

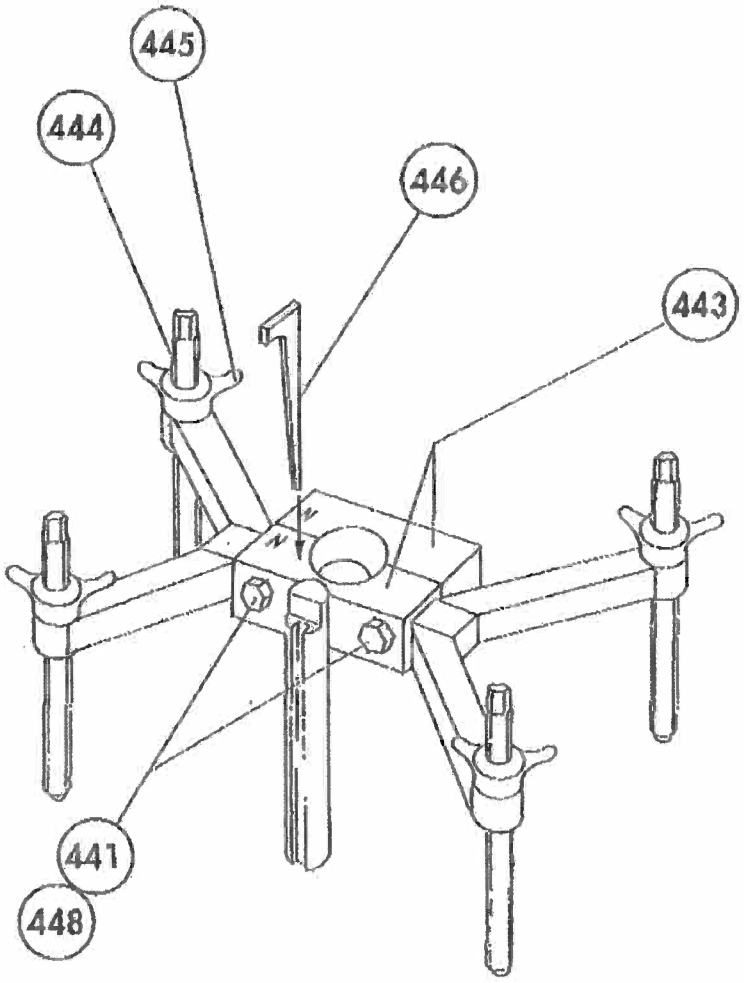


PLATE 2

Puntone di ancoraggio / Down jack

Code	Pos.	Q.ty	Descizione	Description
07-06	0441	2	Rondella	Washer
07-06	0443	1	Supporto centrale completo	Down jack
07-06	0444	4	Vite di livellamento	Levelling screw
07-06	0445	4	Controdado a farfalla	Lock nut
07-06	0446	1	Spina di fissaggio	Single fixing wedge
07-06	0448	2	Vite	Screw

PLATE 3
Gruppo comandi / Control panel

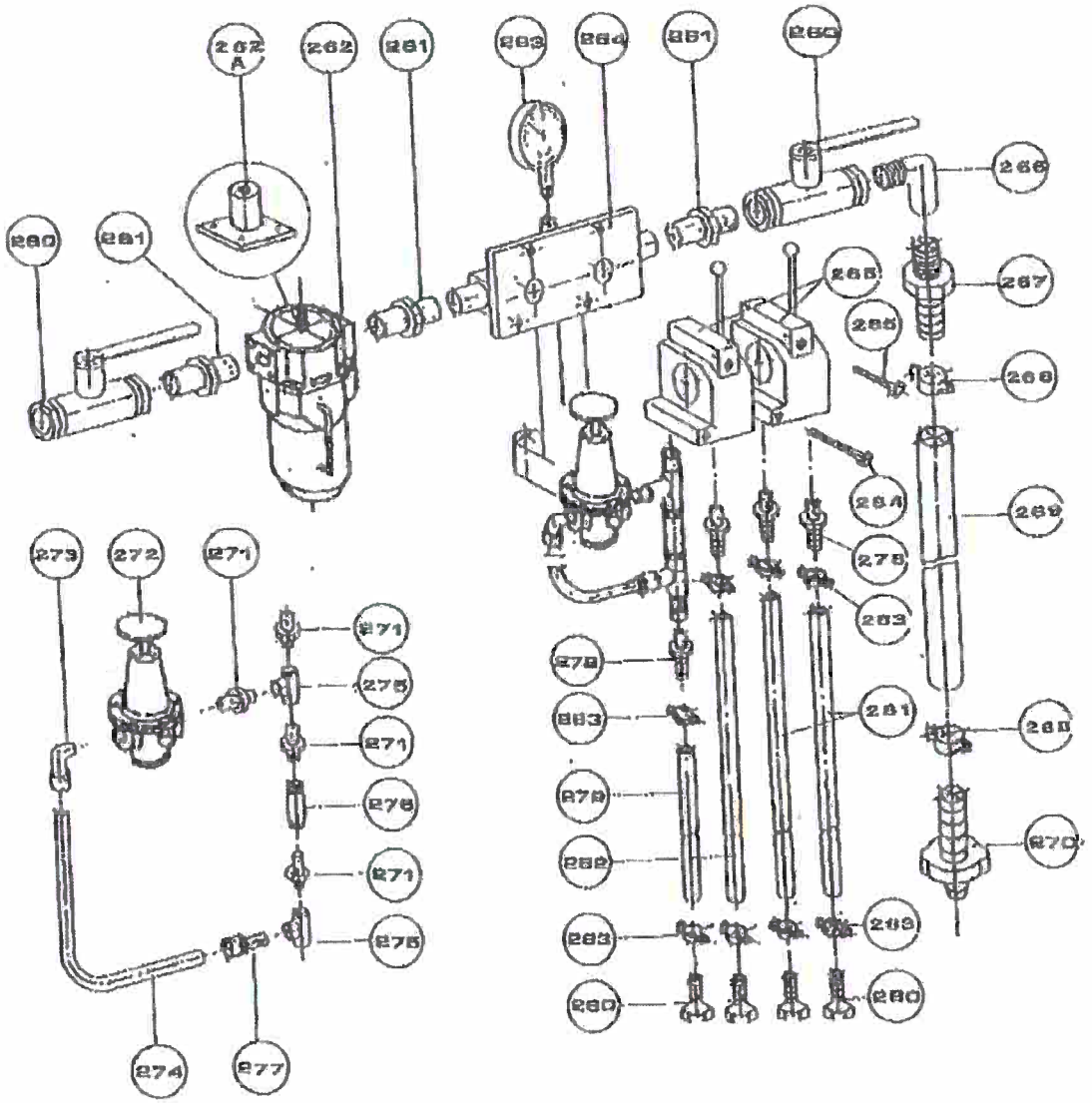


PLATE 3

Gruppo comandi / Control panel

Code	Pos.	Q.ty	Descizione	Description
22-05	0260	2	Valvola di comando da 1"1/2	1"1/2 control valve
22-05	0261	3	Raccordo maschio/maschio da 1"1/2	Male/male 1" connector
22-05	0262	1	Lubrificatore da 1"1/2	1"1/2 lubricator
22-05	0262 A	1	Visualizzatore per oliatore	Oiler visualizer
22-05	0263	1	Manometro	Manometer
22-05	0264	1	Supporto per comandi	Control panel rest
22-05	0265	2	Distributore aria	Air distributor
22-05	0266	1	Curva	Elbow
22-05	0267	1	Portagomma	Air-hose holder
22-05	0268	2	Briglia stringitubo	Air-hose tightener
22-05	0269	1	Tubo di gomma da 1"	1" air-hose
22-05	0270	1	Portagomma per raccordi conici	Conical air-hose holder
22-05	0271	4	Raccordo maschio/maschio	Male-male nipple
22-05	0272	1	Regolatore di pressione	Pressure regulator
22-05	0273	1	Raccordo 90° per tubo in nylon	Nylon air-hose holder
22-05	0274	1	Tubo in nylon	Nylon tube
22-05	0275	2	Raccordo a T	"T" connector
22-05	0276	1	Valvola di ritegno (non ritorno)	Retaining valve
22-05	0277	1	Raccordo diritto per tubo in nylon	Stright connector for nylon air-hose
22-05	0278	4	Portagomma	Air-hose holder
22-05	0279	1	Tubo in gomma 1/2"	1/2" air-hose
22-05	0280	4	Raccordo rapido per gomma	Quick connector 3/4" air-hose
22-05	0281	2	Tubo di gomma1/2"	1/2" air-hose
22-05	0281 A	0	Tubo 1/2" completo di raccordo	1/2" air-hose with connector
22-05	0282	1	Tubo di gomma1/2"	1/2" air-hose
22-05	0283	8	Briglie per tubo da 1/2"	Tightener for 3/4" air-hose
22-05	0284	4	Vite di fissaggio TE M10x90	TE M10x90 locking screw
22-05	0285	2	Vite di fissaggio TE M10x75	TE M10x75 locking screw

PLATE 4
Motore testa di rotazione / Motor rotating head

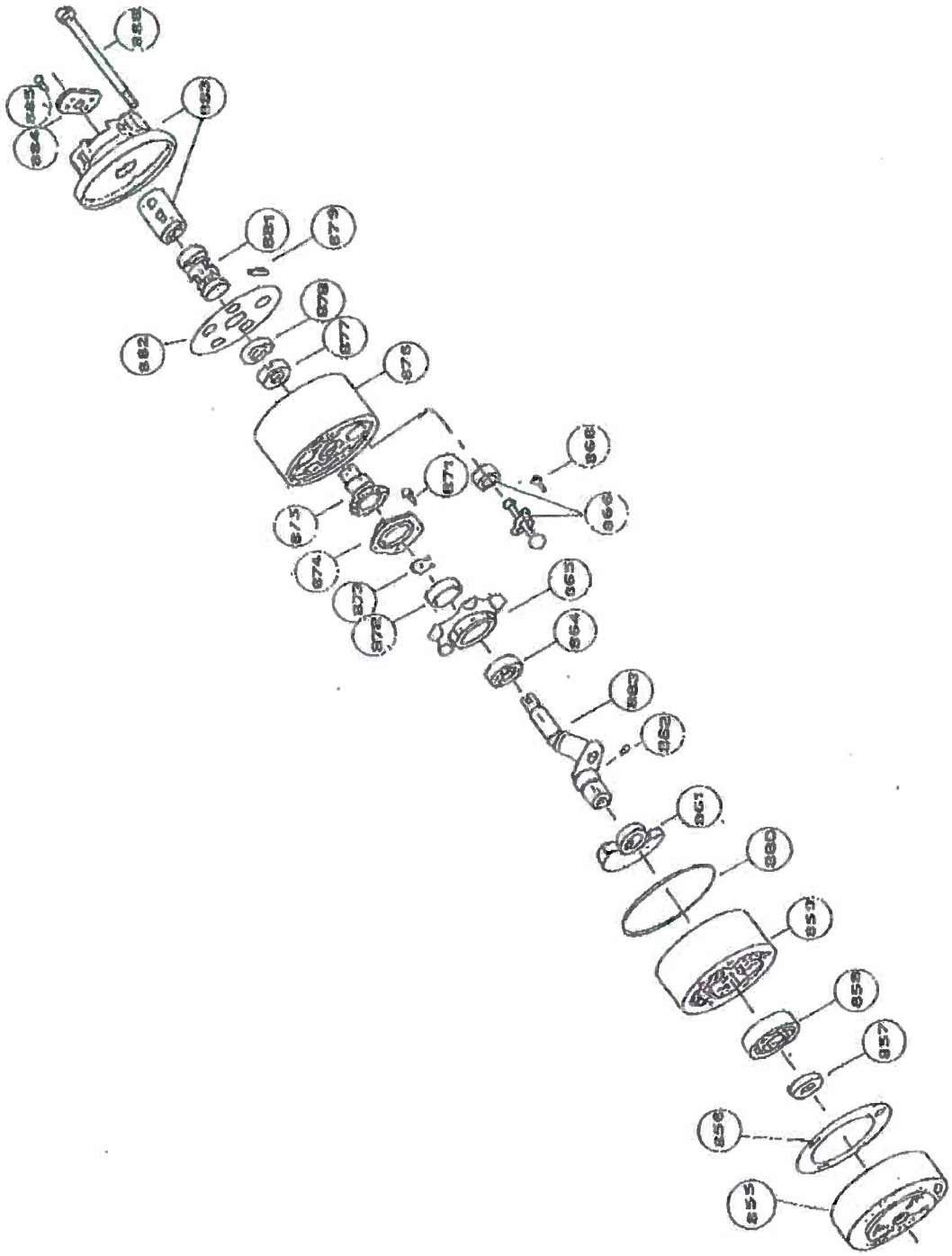


PLATE 4

Motore testa di rotazione / Motor rotating head

Code	Pos.	Q.ty	Descizione	Description
00-01	0855	1	Flangia chiusura motore	Terminal flange
00-01	0856	1	Guarnizione flangia	Flange gasket
00-01	0857	1	Anello di tenuta	Junk ring
00-01	0858	1	Cuscinetto albero lato contrappeso	Shaft bearing counterweight side
00-01	0859	1	Carcassa intermedia	Casing
00-01	0860	1	Anello tenuta carcassa	Casing junk ring
00-01	0861	1	Contrappeso per albero a gomito	Crankshaft counterweight
00-01	0862	1	Perno riferimento contrappeso	Counterweight pin
00-01	0863	1	Albero a gomito	Crankshaft
00-01	0864	1	Cuscinetto obliquo per piatto portabiella	Bearing for connecting rod holder plate
00-01	0865	1	Piatto portabiella	Connecting rod holder plate
00-01	0866	5	Biella	Piston compl. with conn. rod & flange
00-01	0867	1	Coperchio per biella	Cap for connecting rods (see pos.865)
00-01	0868	10	Vite fissaggio biella	Screw
00-01	0869	5	Pistone	Piston (see pos.866)
00-01	0870	5	Camicia cilindro	Cylinder liner (see pos.867)
00-01	0871	5	Vite fissaggio ingranaggio conico su piatto	Fixing screw for conical gear
00-01	0872	1	Cuscinetto	Bearing
00-01	0873	1	Anello seger albero a gomito	Crankshaft seeger ring
00-01	0874	1	Ingranaggio conico su albero	Shaft conical gear
00-01	0875	1	Ingranaggio conico su corpo	Casing conical gear
00-01	0876	1	Corpo motore	Motor casing complete with cylinder
00-01	0877	1	Ghiera fissaggio ingranaggio conico	Ring nut conical gear fixing
00-01	0878	1	Cuscinetto albero lato valvola	Shaftbearing valve side
00-01	0879	1	Chiavetta trascinamento valvola	Valve movement spline
00-01	0880	1	Bussola valvola distribuzione	Inlet valve sleeve (see pos.883)
00-01	0881	1	Valvola rotativa di distribuzione	Rotating inlet valve
00-01	0882	1	Guarnizione testata	Head gasket
00-01	0883	1	Testata porta valvola	Valve holder head gasket with sleeve
00-01	0884	1	Coperchio testata	Head gasket cap
00-01	0885	4	Vite fissaggio coperchio	Head gasket fixing screw
00-01	0886	5	Vite assemblaggio motore	Motor assembling screw

PLATE 5
Riduttore testa di rotazione / Reduction gear rotating head

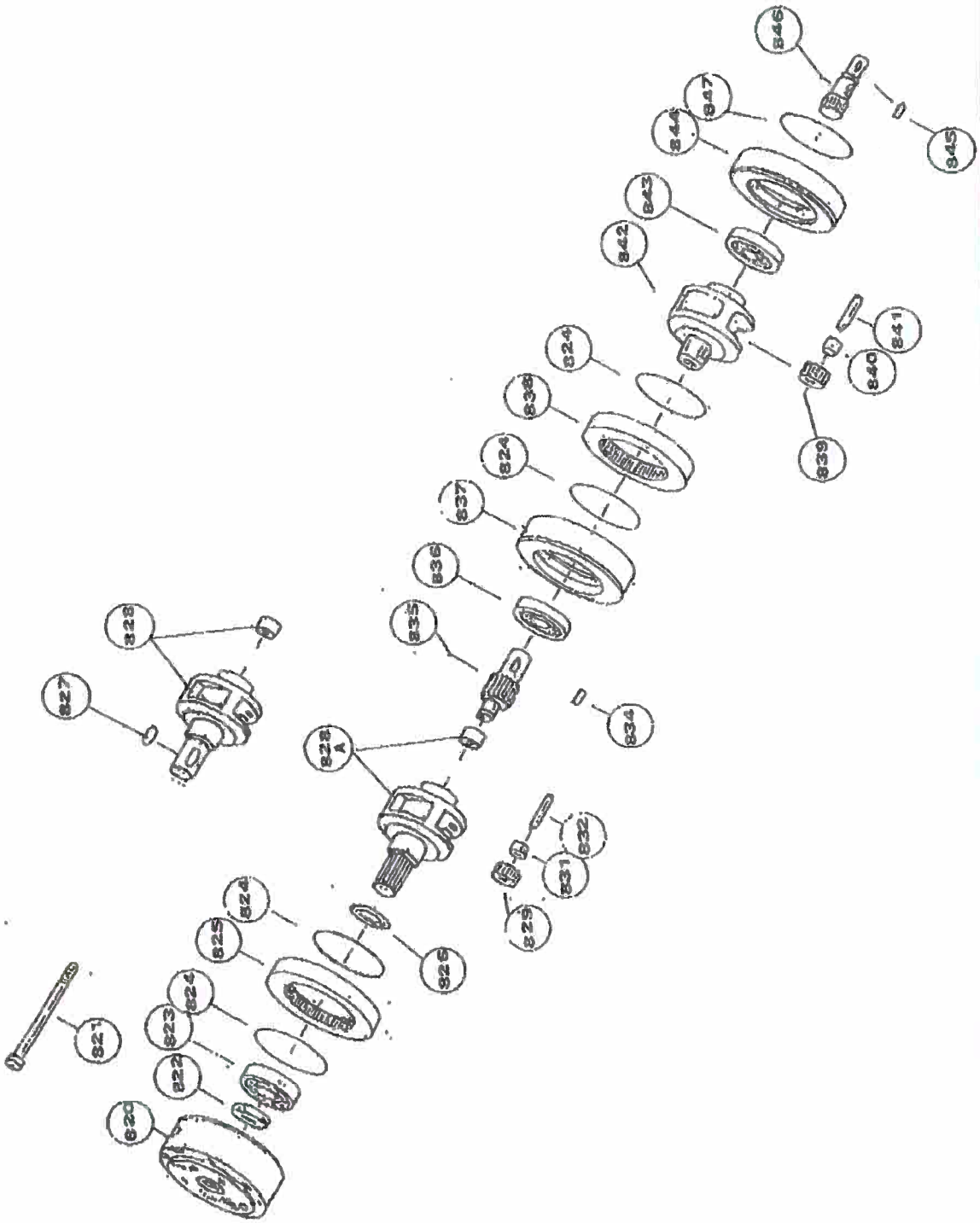


PLATE 5

Riduttore testa di rotazione / Reduction gear rotating head

Code	Pos.	Q.ty	Descizione	Description
00-02	0820	1	Flangia attacco	Cannecting flange
00-02	0821	5	Viti fissaggio riduttore doppio	Fixing screw
00-02	0822	1	Anello tenuta corteco	Corteco stopper ring
00-02	0823	1	Cuscinetto porta satelliti	Bearing for side pinion holder
00-02	0824	4	Anello tenuta flangia	Flange stopper ring
00-02	0825	1	Corona dentata Z 45	Z 45rown gear
00-02	0826	1	Rondella distanziale per supporto	Distance ring washer for rest
00-02	0827	1	Chiavetta albero in uscita	Shaft out spline
00-02	0828	1	Portasatelliti completo di bronzina	Side pinion holder with bushing
00-02	0829	3	Ingranaggio satelliti Z 15	Z15ear for side pinion
00-02	0831	3	Cuscinetti a rullini per satelliti	Side pinion bearing
00-02	0832	3	Perni portasatelliti	Side pinion pin
00-02	0833	1	Cuscinetto a rulli pignone dentato	Bushing (see pos.828)
00-02	0834	1	Chiavetta pignone dentato	Crown pinion spline
00-02	0835	1	Pignone dentato	Z12 crown pinion
00-02	0836	1	Cuscinetto portasatelliti	Side pinion bearing
00-02	0837	1	Distanziale 2ª riduzione	2nd reduction distance ring
00-02	0838	1	Corona dentata Z 60	Z60 crown gear
00-02	0839	3	Ingranaggi satelliti Z24	Z24 side pinion gear
00-02	0840	3	Cuscinetti a rulli per satelliti	Side pinion bearing
00-02	0841	3	Perni per satelliti	Side pinion pin
00-02	0842	1	Supporto portasatelliti	Side pinion holder rest
00-02	0843	1	Cuscinetto portasatelliti	Side pinion bearing
00-02	0844	1	Flangia collegamento riduttori	Reduction gear connecting flange
00-02	0845	1	Chiavetta per pignone dentato	Spline for crown pinion
00-02	0846	1	Pignone dentato Z 12	Z12 crown pinion
00-02	0847	1	Anello di tenuta	Locking ring

PLATE 6

Gruppo di uscita testa di rotazione / Connecting group rotating head

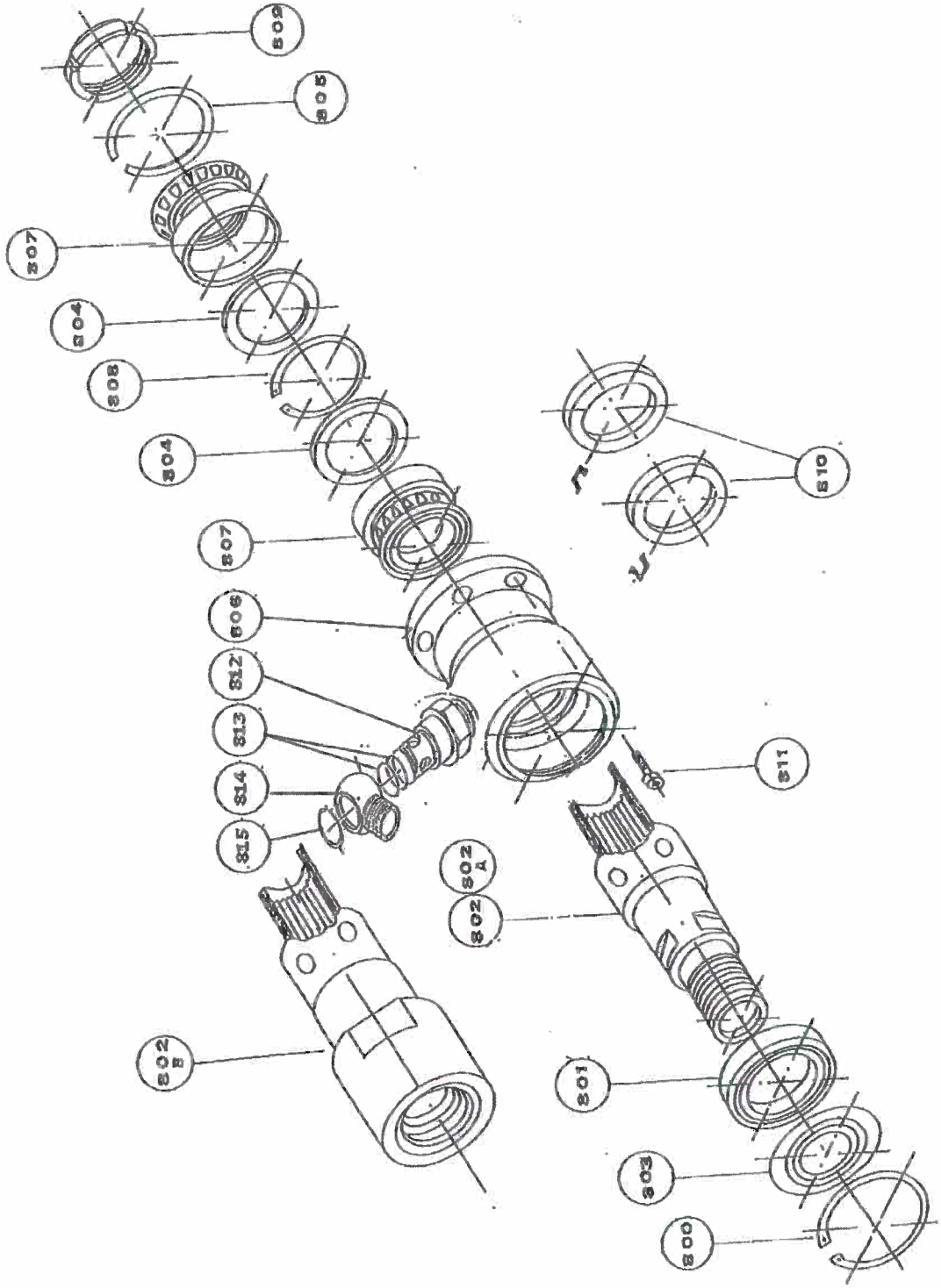


PLATE 6

Gruppo di uscita testa di rotazione / Connecting group rotating head

Code	Pos.	Q.ty	Descizione	Description
00-17	0800	1	Anello seeger	Seeger ring
00-17	0801	1	Cuscinetto	Bearing
00-17	0801 A	1	Cuscinetto API 2" 3/8	API2" 3/8 bearing
00-17	0802	1	Albero uscita RD50	RD50 shaft out
00-17	0802 A	1	Albero uscita RD40	RD40 shaft out
00-17	0802 B	1	Albero uscita API 2" 3/8	API 2" 3/8 shaft out
00-17	0803	1	Anello nilos	Nilos ring
00-17	0804	2	Distanziale	Spacer
00-17	0805	1	Anello di arresto	Stop ring
00-17	0806	1	Scatola avional	Avional casing
00-17	0807	2	Cuscinetto conico	Conical bearing
00-17	0808	1	Seeger	Seeger
00-17	0809	1	Ghiera autobloccante	Self locking ring nut
00-17	0810	2	Guarnizione in gomma	Rubber gasket
00-17	0811	5	Vite testa cava	Socket head screw
00-17	0812	1	Immissione aria	Feeling tube
00-17	0813	2	O ring	O ring
00-17	0814	1	Connessione aria	Air connection
00-17	0815	1	Seeger	Seeger

PLATE 7
Motore avanzamento testa / Pneumatic feed motor

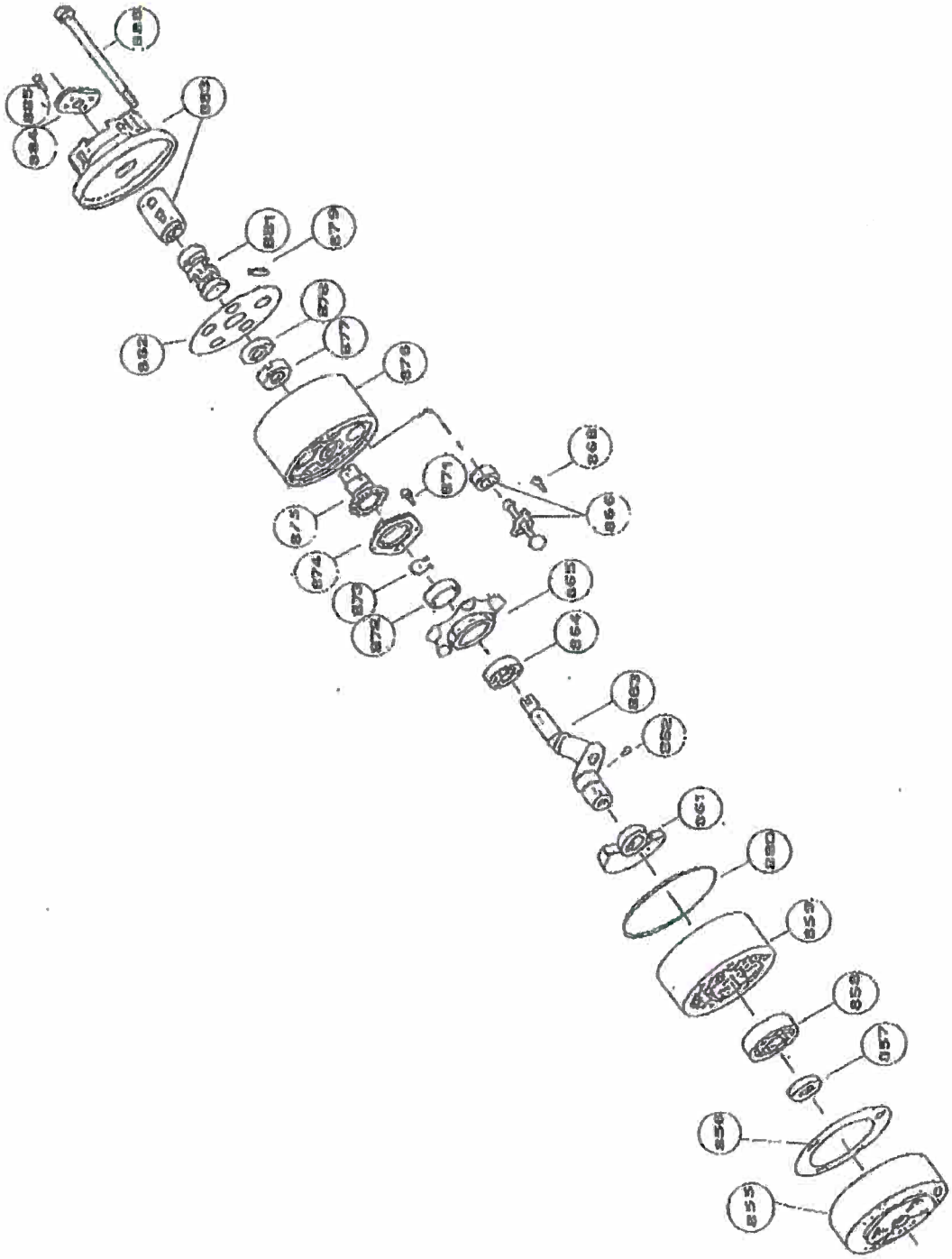


PLATE 7
Motore avanzamento testa / Pneumatic feed motor

Code	Pos.	Q.ty	Descizione	Description
00-16	0855	1	Flangia chiusura motore	Terminal flange
00-16	0856	1	Guarnizione flangia	Flange gasket
00-16	0857	1	Anello di tenuta	Junk ring
00-16	0858	1	Cuscinetto albero lato contrappeso	Shaft bearing counterweight side
00-16	0859	1	Carcassa intermedia	Casing
00-16	0860	1	Anello tenuta carcassa	Casing junk ring
00-16	0861	1	Contrappeso per albero a gomito	Crankshaft counterweight
00-16	0862	1	Perno riferimento contrappeso	Counterweight pin
00-16	0863	1	Albero a gomito	Crankshaft
00-16	0864	1	Cuscinetto obliquo per piatto portabiella	Bearing for connecting rod holder plate
00-16	0865	1	Piatto portabiella	Connecting rod holder plate
00-16	0866	5	Biella	Piston compl. with conn. rod & flange
00-16	0867	1	Coperchio per biella	Cap for connecting rods (see pos.865)
00-16	0868	10	Vite fissaggio biella	Screw
00-16	0869	5	Pistone	Piston (see pos.866)
00-16	0870	5	Camicia cilindro	Cylinder liner (see pos.867)
00-16	0871	5	Vite fissaggio ingranaggio conico su piatto	Fixing screw for conical gear
00-16	0872	1	Cuscinetto	Bearing
00-16	0873	1	Anello seger albero a gomito	Crankshaft seeger ring
00-16	0874	1	Ingranaggio conico su albero	Shaft conical gear
00-16	0875	1	Ingranaggio conico su corpo	Casing conical gear
00-16	0876	1	Corpo motore	Motor casing complete with cylinder
00-16	0877	1	Ghiera fissaggio ingranaggio conico	Ring nut conical gear fixing
00-16	0878	1	Cuscinetto albero lato valvola	Shaftbearing valve side
00-16	0879	1	Chiavetta trascinamento valvola	Valve movement spline
00-16	0880	1	Bussola valvola distribuzione	Inlet valve sleeve (see pos.883)
00-16	0881	1	Valvola rotativa di distribuzione	Rotating inlet valve
00-16	0882	1	Guarnizione testata	Head gasket
00-16	0883	1	Testata porta valvola	Valve holder head gasket with sleeve
00-16	0884	1	Coperchio testata	Head gasket cap
00-16	0885	4	Vite fissaggio coperchio	Head gasket fixing screw
00-16	0886	5	Vite assemblaggio motore	Motor assembling screw
00-16	0800	1	Motore completo	Complete motor

MARINI QUARRIES GROUP

PLATE 8
Riduttore di avanzamento / Reduction gear

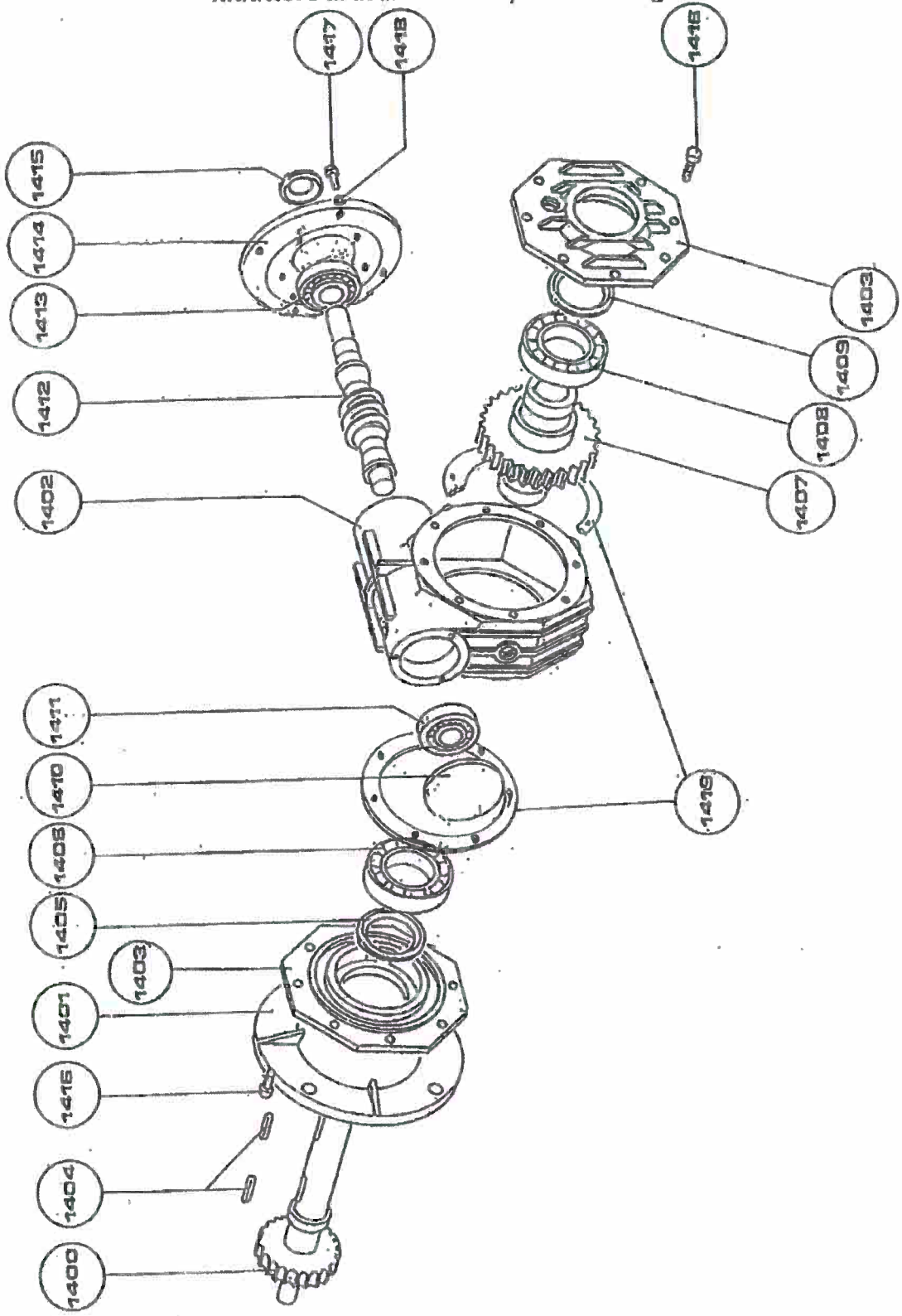


PLATE 8
Riduttore di avanzamento / Reduction gear

Code	Pos.	Q.ty	Descrizione	Description
00-13	0000	1	Riduttore MCDP-MCP escluso di albero e pignone d'uscita	MCDP-MCP reduction gear (Shaft and sprocket wheel excluded)
00-13	1400	1	Albero con pignone per catena 1"	Shaft and sprocket wheel
00-13	1401	1	Flangia di raccordo	Jointing flange
00-13	1402	1	Carcassa riduttore	Reduction gear casing
00-13	1403	1	Coperchio riduttore	Reduction gear cover
00-13	1404	2	Chiavetta	Spline
00-13	1405	1	Paraolio	Oil seal
00-13	1406	1	Cuscinetto	Bearing
00-13	1407	1	Corona in bronzo	Bronz crown
00-13	1408	1	Cuscinetto	Bearing
00-13	1409	1	Paraolio corteco	Oil seal
00-13	1410	1	Coperchio vite senza fine	Worn cover
00-13	1411	1	Cuscinetto vite senza fine	Worn bearing
00-13	1412	1	Vite senza fine	Worn
00-13	1413	1	Cuscinetto vite senza fine	Worn bearing
00-13	1414	1	Flangia attacco motore	Motor jointing flange
00-13	1415	1	Paraolio corteco	Oil seal
00-13	1416	8	Vite a brugola	Socket head screw
00-13	1417	3	Vite a brugola	Socket head screw
00-13	1418	3	Rondella	Washer
00-13	1419	2	Guarnizione	Seal

Item	Q.ty	Description	Unit price EURO	Total price EURO
5.5	1	**MINI MAST** : Slide holder plate with 360° manual turn table suitable for 2-3 ton excavator.	1.135,00	

5.6	1	**MINI MAST :** Slide holder plate with 360° manual turn table suitable for 2-3 ton excavator complete with excavator fixing bracket.	1.700,00	

Item	Q.ty	Description	Unit price EURO	Total price EURO
		SLIDE MOUNTING FRAMES		
5.1	1	Slide mounting frame mod."**DACHS**" made up : Tubular frame to operate in a very slope area complete with no. 3 folding supports for moving on uneven ground 360° manual rotating slide holder bracket Slide brace fixing bracket Slide brace device (**Note** : Slide CID 80 complete ,control panel, not included)	3.770,00	

5.2 1 Wheel kit dim. 460x215 mm (2 wheels) 920,00

WHEELED SUPPORT FOR DACHS FRAME (460X215)

The Sullair 375HH Portable Air Compressor

375 cfm at 200 psig ■ 10.6 m³/min at 14 bar

- Rotary screw compressor
- Removable modular canopy
- Adjustable height hitch
- E-Z lube axle
- Large tool box compartment
- Curbside instrument panel
- SSAM–Shutdown System and Annunciation Module
- Battery disconnect switch
- Idle warm-up valve
- Emergency stop
- Rocker type start switch
- Protective shutdown switches
- Fuel/Water separator
- Three-Stage air filters
- 0 to 100% capacity control
- Pneumatic inlet valve
- AWF Compressor Fluid
- Durable powder coat finish
- Wide track
- Galvanneal sheet metal
- Recessed tail lights
- Rear bumper

SULLAIR®

Always air. Always there.

Total Accessibility
Routine maintenance is simplified.

Large Tool Box Compartment
Sullair pneumatic tool sold separately.

Rotary Screw Compressor by Sullair
The pioneer in rotary screw technology.

Sullair AWF Compressor Fluid
Improved hot and cold weather lubrication. Longer compressor fluid life. Extended air end warranty.

Designed for Total Accessibility and Reliability

Rotary Screw Compressor

Ample Service Doors
- Large service doors provide access to fuel tank, engine, compressor air filters and tool compartment
- Rear service panel provides access to side-by-side compressor fluid cooler, engine air cooler and engine radiator
- Serviceable components within easy reach
- Routine maintenance is simplified
- Reduced downtime and service cost
- Service doors feature non-rusting hinges and stainless steel T-type door retainers

Multi-Piece Canopy
- Modular design reduces replacement costs
- Easily removed as one assembly for major service
- Exposed, single point lifting ball

0 to 100% Capacity Control
- Pneumatic inlet valve and unloaded starting

Highway Towable Running Gear
- 3" x 5" drawbar
- Adjustable height hitch (15", 17", 19")
- Quick-change hitch
- Screw jack with pad
- Transport security chains
- E-Z lube axle lubrication
- Heavy duty leaf spring suspension

Curbside Instrument Panel
- Hinged, padlockable cover
- Powerview gauge module with mechanical air pressure gauge
- Rocker type engine start switch
- Idle warm-up valve
- High/low pressure selector valve allows dual pressure capability without making mechanical adjustments

SSAM–Shutdown System & Annunciation Module
- Shutdown with annunciator light for high compressor temperature, high engine coolant temperature, low engine oil pressure and engine underspeed
- Low fuel shutdown

Three-Stage Dry Type Air Filters
- Separate filters for engine and compressor

Durable, Baked-On Powder Coat Finish

Tier 3 Emission Compliant Engines

Air End Warranty
- 2-year standard warranty
- 5-year or 10,000-hour warranty when continuously serviced at the recommended intervals with Sullair AWF Compressor Fluid and filters

Quiet Operation
- Meets US EPA sound requirements of 76 dBA @ 7 meters

Customize the compressor to meet your specific requirements with Sullair's options

Filtration for instrument quality air
Aftercooler
Special paint
Hose reels, single and dual
Spark arrestor
Cold weather starting aid
Fuel level gauge
Brakes (recommended where required by law)
Mechanical parking brakes
Ball hitch
Air filter maintenance indicators
Block heater
Ether starting aid

SPECIFICATIONS, WEIGHTS AND DIMENSIONS—SULLAIR 375HH PORTABLE COMPRESSOR

Delivery @ Rated Pressure	Rated Pressure psig	bar	Pressure Range psig	bar	Designated Model	Weight (wet) lbs	kg	Weight (dry) lbs	kg	Length (drawbar) in	mm	Length (canopy) in	mm	Width in	mm	Height in	mm	Track Width in	mm	Tire Size (load range)
375 acfm 177 l/s 10.6 m³/min	200	14	80–200	5.5–14	2-Wheel	4440	2014	4050	1837	156.1	3966	98.8	2510	77.2	1960	74	1880	67.5	1715	225/75D15
					Less Running Gear	4195	1903	3805	1726	–	–	98.8	2510	59.3	1506	63.6	1616	–	–	–

Engine Make	Engine Type	Engine Model	Displacement in³	cc	Cylinders	Bore and Stroke in	mm	Rated Speed rpm	Rated Power hp	kW
John Deere (Tier 3 emission compliant)	Diesel	4045HF285	275	4507	4	4.19 x 5.00	106 x 127	2200	140	104

Capacity per CAGI/PNEUROP PN2CPTC3. (Annex D to ISO 1217)

SULLAIR
Always air. Always there.

Sullair
3700 East Michigan Boulevard
Michigan City, IN 46360
Telephone: 219-879-5451
www.sullair.com

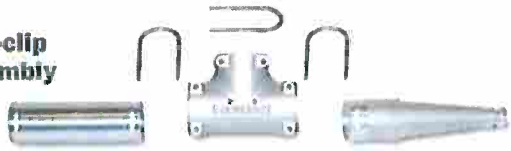
© Copyright 2012 Sullair. All rights reserved.
The color green is a registered trademark of Sullair.
Specifications subject to change without notice.
SSL-1173 1209R

Like us on Facebook.

The paper used in printing this literature was manufactured using recycled fiber, either pre-consumer or post-consumer waste, therefore less harmful to the environment because less virgin fiber is used, thereby reducing tree harvesting, water usage, energy consumption, emission of greenhouse gases and pollution.

ChemGrout

CG-030 Rapid U-clip Disassembly



The Rugged Series features a single acting, variable speed 3" piston pump that provides the versatility to handle materials ranging from fluid slurries to heavily sanded grouts. Materials commonly used with the CG-030 include cement slurries, sanded cement mixes, bentonite mixes (with or without sand), most repair mortars, high-strength non-shrink grouts and self-leveling products.

The CG-030 is engineered for ease of operation and low cost maintenance. The unique staple lock construction holds all working components together allowing parts to be easily accessed for cleaning and maintenance.

The large capacity hopper is mounted above the suction housing, enabling a new batch to be mixed while the first is being pumped. This helps to provide a consistent "non-stop" discharge of material, virtually eliminating the clogging of tremmie lines.

CG-030 Piston Pump Skid Mounted

Complete grouting systems combine the CG-030 piston pump with a high efficiency paddle mixer to provide a continuous output of material. Both mixer and pump are equipped with their own variable speed control.

The large 45-gallon mix tank features specially designed blades and baffles that develop a high shearing action, insuring rapid and thorough mixing. After mixing, the material is transferred to a holding hopper through a slide gate designed to handle the most difficult materials. Holding hoppers are available in 15-gallon (57 liter) or 30-gallon (113 liter) sizes and are matched based on material flow.

The compact, skid mounted CG-550/030 is available in either air or hydraulic power. Hydraulic power units with either a gasoline/diesel engine or an electric motor can also be mounted on a separate skid. The trailer mounted CG-555 is a fully integrated system combining mixer, pump and power system, all in a single road worthy package.

Specifications

CG030 Skid - Power	Max. Output/Pressure	Required	Weight	Size
Air	16 gpm (60 lpm), 400 psi (27 bar)	100 cfm, 100 psi	310 lbs	64" x 31" x 29"
Hydraulic	14 gpm (53 lpm), 400 psi (27 bar)	9 gpm, 2000 psi	290 lbs	64" x 31" x 29"

CG550/030 Skid Power	Max. Output/Pressure	Required	Weight	Size
Air	16 gpm (60 lpm), 400 psi (27 bar)	150 cfm, 100 psi	490 lbs	66" x 31" x 56"
Hydraulic	14 gpm (53 lpm), 400 psi (27 bar)	2 Supplies each of 9gpm, 2000 psi	450 lbs	66" x 31" x 56"
Electric/Hydraulic	14 gpm (53 lpm), 400 psi (27 bar)	*3 Phase	955 lbs	84" x 34" x 56"
Gas/Hydraulic, Electric Start	14 gpm (53 lpm), 400 psi (27 bar)	Self-Contained	955 lbs	84" x 34" x 56"
Diesel/Hydraulic	14 gpm (53 lpm), 400 psi (27 bar)	Self-Contained	1050 lbs	84" x 34" x 56"

CG555/030 Trailer - Pwr	Max. Output/Pressure	Required	Weight	Size
Gas/Hydraulic	14 gpm (53 lpm), 400 psi (27 bar)	Self-Contained	1400 lbs	110" x 60" x 70"
Diesel/Hydraulic	14 gpm (53 lpm), 400 psi (27 bar)	Self-Contained	1495 lbs	110" x 60" x 70"

* Several Voltages Available

Accessories

Grout Hose. Equipped with quick disconnect fittings. Available in 25 and 50 foot lengths.

Water Meters. Available in manual or automatic. Accurately measures the water for each batch.

Diaphragm Protected Pressure Gauge.

Mechanical Surface Packer. Equipped with shut-off valve and a quick disconnect fitting.

Applications include:
Soil nails, tiebacks, earth anchors, cable & rock bolts, foundation stabilization, soil compaction, pavement undersealing, slabjacking, slab raising, underwater foundations, piers, deep well casing, well sealing, abandonment and geothermal.

ChemGrout®

Widest Selection of Grouting Equipment in the World

ChemGrout, Inc., P.O. Box 1140, 805 E. 31st Street, LaGrange Park, IL 60526 USA • Phone: (708) 354-7112 • Fax: (708) 354-3881
Visit our web site: www.chemgrout.com • E-mail: info@chemgrout.com

ChemGrout®

CG-550 Rugged Series

Combines ease of operation and low maintenance to provide the ultimate in performance.

CG550/030/A
Air Powered

CG550/030/GHES
Gas/Hydraulic

CG555/030/GHES
Gas/Hydraulic

Single operator system – 45 gallon (170 liter) mixing tank, large holding hopper and centrally located controls allow a single operator to mix, transfer and pump for continuous production.

Efficiently mixes and pumps most pre-packed non-shrink grouts and repair mortars. Materials include bentonites, cement/sand and most slurry products.

Outputs to 16 gpm (60 lpm), 400 psi (27 bar).

Power options include air, electric/hydraulic, hydraulic, gas/hydraulic and diesel/hydraulic.

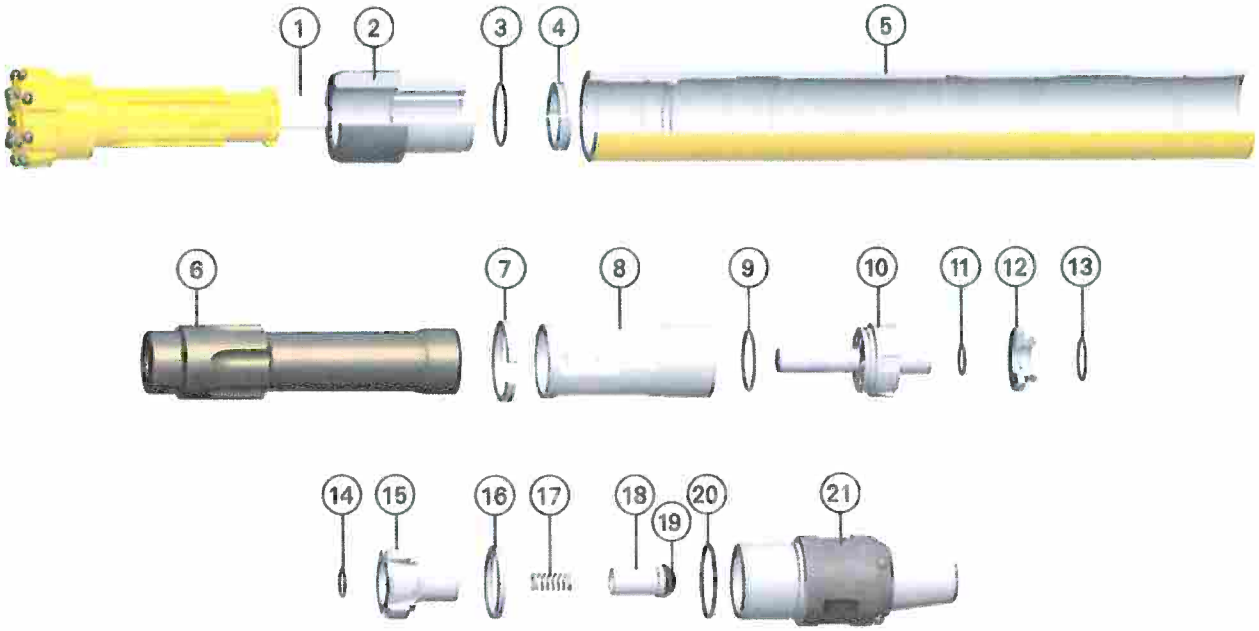
Pump completely disassembles with only a hammer for fast and thorough cleaning.

ChemGrout®

Widest Selection of Grouting Equipment in the World

Secoroc QL 340

Down-the-hole hammer



Ref.	Part	Prod. No.	Product code
1	Foot valve	86002883	9227
2	Chuck	92050398	9704-03-54-00-001
3	O-ring (bit retain)	92050396	9704-03-54-00-003
4	Ring- bit retain	92050395	9704-03-54-00-002
5	Casing	92050397	9704-03-54-00-004
6	Piston	92050403	9704-03-54-00-005
7	Cylinder retain ring	92050400	9704-03-54-00-062
8	Cylinder	92050399	9704-03-54-00-048
9	O-ring (distributor)	92050402	9704-03-54-00-038
10	Distributor	92050401	9704-03-54-00-042
11	O-ring (inner valve)	92050409	9704-03-54-00-027
12	Valve	92050404	9704-03-54-00-044
13	O-ring (outer valve)	92050408	9704-03-54-00-036
14	O-ring (valve cap)	92050406	9704-03-54-00-037
15	Valve cap	92050405	9704-03-54-00-074
16	Shim	92050414	9704-03-54-00-026
17	Spring	92050411	9704-03-54-00-016
18	Check valve	92050407	9704-03-54-00-015
19	Check valve cap	92050238	970D-00-82-00-036
20	O-ring backhead	92050394	9704-00-54-00-019
21	Backhead	92050393	9704-03-54-00-020

Hammers and Kits	Prod. No.	Product code
QL 340 hammer, complete	92050412	9704-03-54-00
Valve assembly	92050442	9704-00-54-00-045
O-ring kit, 1x3, 1x9, 1x11, 1x12, 1x13, 1x14, 1x20	92050441	9704-00-54-00-047
E-kit	92050440	9704-03-54-00-040

Wear limits		
Casing	Min.OD	92mm
Piston/Casing clearance	Max	0.2mm
Piston/Control tube	Max	0.2mm
Foot valve	Min.OD	26.3mm
Foot valve protrusion		57+/- 1mm

9853 1102 01 2011.07

Atlas Copco Secoroc AB
Box 521, SE-737 25 Fagersta, Sweden
Phone +46 223 461 00
E-mail: secoroc@se.atlascopco.com
www.atlascopco.com

Atlas Copco