AMERICAN MARINE INTERNATIONAL

Hilcorp MGS Pipeline Leak Investigation & Repair Project Plan

EXCELLENCE IN OPERATIONS™

ADC INTERNATIONAL

IMCA Member

3-1-2017 Rev. 3

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Project Overview

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Hilcorp MGS Pipeline Leak Investigation & Repair Project Overview

Project Manager or Captain shall contact the Coast Guard Tasks Desk in Homer before advancing into the leak zone perimeter.

- Leak investigation for the identified 8-inch undersea pipeline located near Platform A in Middle Ground Shoal (MGS) for Hilcorp Alaska, LLC
- *DSV Shamrock* has been de-winterized and will be mobilized and utilized as the marine dive platform is support of the pipeline leak investigation
- Locate pipeline at leak site and mark with a buoy
- If needed, excavate seafloor around pipeline to gain access for thorough root cause inspection
- Inspect the external coating of the pipeline making note of the type and condition of the coating, *i.e.* satisfactory, disbonded, deteriorated, scraped, bare metal or other
- Identify any pipeline coating or weight coat still remaining on the pipeline and take measurements.
- Using an ovality gauge take measurements on each side of the pipeline to ensure the ovality of the pipeline is not compromised
- Document the GPS location of the leak location
- NDE Inspection: take CP and UT measurements around leak location
- Install a temporary or permanent repair depending on investigation findings
- Proper surface preparation will be required prior to pipeline repairs such as cleaning to bare metal utilizing pneumatic, hydraulic, and hand tools

Document Approval / Concurrences by Signatures or E-Mail

AMI Senior Project Manager _____ Date: _____

AMI Diving Supervisor _____ Date: _____

Hilcorp Project Manager _____ Date: _____

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Hilcorp MGS Pipeline Leak Investigation & Repair Project Contact Sheet

Company	Title	Office	Mobile	Fax	E-Mail
American Marine					
TO BE SUPPLIED AT A FUTURE DATE					
Hilcorp Alaska LLC					
TO BE SUPPLIED AT A FUTURE DATE					

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Project Mobilization and On-Site Preparations

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Project Communication Plan

REVIEW STATUS						
Rev	Date	Description	By	Checked	Approved	Client

1.0 PURPOSE

1.1 American Marine International (AMI) developed the following Communication Plan (CP) to ensure constant communications is established and maintained between all key parties during diving operations. This CP is a case specific procedure for the Hilcorp MGS Pipeline Leak Investigation and Repair Project.

2.0 COMMUNICATION PROCEDURE

2.1 There shall be hardwire communications maintained between the Diver, Standby Diver, and Dive Control using the dive radio hardwire link that runs through the diver's umbilical.

2.2 Communication from the diver shall be broadcast real-time to personnel on deck, using hardwired deck speakers, so that all operations personnel are aware of the activities of the diver and the Dive Supervisor.

2.3 The Dive Supervisor shall be in direct communications with the vessel operator at all times during dive operations.

2.4 The Diver Supervisor shall have a handheld American Marine owned company radio at the dive control station at all times so he may contact the platform control room in case of an emergency.

2.5 The following personnel will be issued American Marine owned UHF radios:

- Dive Supervisor
- DSV Operator
- Platform Control Room Operator
- Pipeline Operator

2.6 Prior to the beginning of any diving operation, a list of all radio channels and phone numbers to be used, shall be posted in the DSV Shamrock wheelhouse and the Dive Control Station.

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2.7 Prior to initiation of dive operations the Dive Supervisor and Platform Control Room will have a Energy Isolation and Lockout / Tagout Permit in place on the gas pipeline supply valves.

3.0 DIVE CONTROL COMMUNICATIONS WITH DSV CRANE AND WINCH OPERATORS

3.1 While divers are in the water, the crane and winch operators shall have direct communications with the Dive Supervisor. All operations should cease if direct communications between all key parties is not established, confirmed, and maintained.

3.2 All topside diving support personnel shall maintain direct communication with the Dive Supervisor. No equipment, materials, or tooling, etc. shall be lowered to the diver or retrieved without approval of the Dive Supervisor.

3.3 The Dive Supervisor shall give instructions to the Platform Crane Operator. When the Dive Supervisor radios instructions to the Crane Operator or Winch Operator the instructions shall include a direction and distance (e.g. swing right 5-feet, down on the load 10-feet etc).

3.4 The appropriate equipment operator (crane, winch) shall repeat the order back (including direction and distance) to the Dive Supervisor to verify that the command was understood. Once the equipment operator has executed the move they will all-stop and confirm over the radio that the direction and distance of movement requested has been executed.

4.0 GAS PIPELINE LO/TO PROCEDURE DURING DIVE OPERATIONS

4.1 Securing the gas LOTO Communications Procedure:

4.1.1 Dive supervisor on the DSV shall use UFH radios to communicate with the platform control room operator and pipeline operator.

4.1.2 Before the diver enters the water, the dive supervisor shall contact the platform and will confirm that the Lock Out and Tag Out has been executed.

4.2 Releasing of energy isolation and Locks on valves:

4.2.1 Lock out / Tag out cannot be removed until the diver is out of the water and the Dive Supervisor shall contact the platform control room and pipeline operator and give the all clear.

4.2.2 Upon removing the locks the platform control room and pipeline operator shall contact the dive supervisor and confirm the locks have been removed.

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Equipment List

AMI Project Specific Equipment/Components

1. Diving Support Vessel (DSV) appropriate for live-boating in Cook Inlet
2. Deep air diving system including decompression chamber
3. Boat mounted A-frame
4. Air powered winches (tuggers), with air regulators
5. Heavy duty 1000 watt sodium lights
6. Computer based GPS navigation system
7. Downline (A-frame mounted) GPS antenna
8. ADCP Doppler current profiler
9. Pipeline downline clamp
10. 50 to 150 pound down weights
11. Spotter buoy system
12. Hard buoys with reflective tape
13. Norwegian buoys
14. Side scan charts
15. Gas detector(s)
16. Oil sample recovery equipment
17. Polypropylene line: 1000 feet of 5/8 or 3/4 inch
18. Diesel powered jet pump, hose, and diver jet (may be left at nearby dock until needed)
19. Diver hand tools
20. Diver dry suits positively attached to diving helmet
21. Close-focus submersible video camera with built in LED lights
22. Sharp slender probes set up with securing devices for finding and marking pinhole leaks
23. Ultrasonic wall thickness measuring equipment
24. Tools for removing plastic pipeline coating: Drawknife, hook knives, wood chisels, HD hacksaw blades
25. Tools for removing concrete weight coat
26. Air chisel gun and bits (for shallow water)
27. Hydraulic chisel gun and bits (for deep water)
28. Hydraulic power pack
29. Inventory of hydraulic tools: chisel gun, grinder, impact wrench
30. Air tool compressor
31. Inventory of air tools: chisel gun, die grinder, angle grinder, impact wrench
32. All necessary impact tools for clamp, including spare sockets, deep sockets, backup wrenches, and spare impact wrenches
33. Extra stud bolts
34. Long bolts of smaller diameter than the stud bolts, with nuts adapted to stud bolt nut size. (Weld long bolt nuts to extra stud bolt nuts)
35. Gap tool: Go/No-go for 1/8 inch gap
36. Small single-part wire come along modified for sucking flanges together
37. Manual torque wrench
38. 2 Hydraulic torques wrenches & power pack

Hilcorp Project Specific Equipment/Components

1. PLIDCO Split+Sleeve
2. H-V Jiffy Clamp

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Dive Support Vessel Shamrock

Home Port:	Homer, Alaska
Dimensions:	70' x 24' x 7'
Main Propulsion:	Twin Detroit Diesel 6-71 (175 hp each) w/Twin Disc MG-509 Marine Gear
Reduction Gears:	Twin Disc-509 Marine
Hull:	Welded steel w/screw tunnel and semi-flat bottom for going dry and ice operations
Speed:	8 knots
Fuel Capacity:	6,000 Gallons *Water Capacity: 2,0*00 Gallons
Electrical:	John Deere 75 kw main with 20kw auxiliary
Engine Cooling:	Keel coolers and compartment unit radiators
Electronics:	Loran C, VHF Radio, Single Side Band Radio, Sperry Auto Pilot, Depth Sounder Multi Receiver DGPS/GPS Units, CCTV System, Deck Comms and Hailing System Workhorse Sentinel 600 kHz ADCP / Bottom Tracking / KVH Digital Fluxgate Compass
Diver Support:	48" Double Lock Decompression Chamber, Bauer and Quincy Breathing Air Compressor, and Dive Equipment Spread for 200+ fsw
Deck Gear:	Hydraulic Power Pak with 45k lb.winch system, hydraulic knuckle crane, hyd. U boom w/1,500 lbs Anchor; 10,000 lbs Air Tugger, 2,000 lbs Air Tuggers, Tool Air Compressor Deck Configuration Modifications Project Specific
Safety Gear:	Bilge and Engine Alarms, Smoke Detectors, Fire Extinguishers, Fire Pumps, Survival Suits, 10 Man Life raft and EPIRB
Accomodations:	11 Berths, Galley, Shower and Head
Area of Operations:	Oceans, Coastwise, Lakes, Bays and Sounds

For further information please contact the American Marine Corporation office nearest you:

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Dive Plan

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Dive Plan

2017 Hilcorp MGS Pipeline Investigation & Repair

Project Overview
Project shall include locating and investigating the root cause of a gas leak on a subsea pipeline located in the Middle Ground Shoal (MGS) of the Cook Inlet, Alaska. American Marine International will mobilize the Dive Support Vessel (DSV) *Shamrock* to the site of the reported leak in order to properly assess the pipeline and provide temporary and/or permanent repairs dependent upon findings from the investigation

The project shall utilize nondestructive examination (NDE), hydraulic and hand tools, cavitation water blaster, repair split sleeve clamp, excavation tools and lifting appliances.

Upon completion of the task, all the rigging and materials shall be removed and dismantled for storage.

1.0 Project Safety

1.1. Only the AMI Dive Supervisor can order the commencement of the dive operation.
1.2. Divers selected for the project will be highly trained, experienced, compliant and competent to perform all tasks associated with the project.
1.3. Anyone can issue a Stop Work Order when an observed safety issue exists.
1.4. All procedures shall be in place and approved prior to the commencement of any diving operation.
1.5. This work site procedure is not considered to be complete until a detailed risk assessment has been performed for each sequential phase of the operation.
1.6. Site ice conditions will be monitored daily for safe operations. Go/No-Go decision will be made after consultation between AMI and Hilcorp management. The following methods will be implemented to monitor ice conditions:
  1.6.1. The DSV master will monitor ice forecasts through the NOAA NWS Alaska Sea Ice Program (ASIP) throughout the day.
  1.6.2. Harley Marine tugs *Bob Franco* and *Millennium Star* (Masters) at Tesoro Dock will be reporting on current conditions throughout the day.
  1.6.3. Flyover updates from Company aircraft will provide local ice, sea state and weather condition updates.
  1.6.4. Operator on Platform A will provide visual monitoring.
1.7. All lifts shall be supported by an approved Lift Plan.
1.8. AMI Dive Supervisor shall conduct a dive plan regarding work that is to be completed for that day.
1.9. Any Management of Change or deviation of the “Worksite Procedure” requires the job to be stopped until the change is reviewed, approved, and communicated. All changes will need to be updated on the Job Hazard Analysis.

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2.0 Mobilization of Dive Spread

2.1. The dive spread for the project is permanently fixed to the vessel except for temperature critical items such as helmets, test equipment and radios. These items shall be taken to the DSV at the time the dive team is mobilized.

2.2. A list of all compliant equipment shall be documented before operations are conducted.

3.0 Onsite Diving Operations

3.1. AMI dive crew shall assemble the dive spread on the *DSV Shamrock* at the site of investigation.

3.2. All equipment shall be function tested and inspected for compliance before any diving operations are to commence.

3.3. Prior to any operations commencement a detailed toolbox safety meeting shall be held in accordance with AMI and Hilcorp requirements.

4.0 Perform Safety Assessment and Dive Inspection of Work Site

4.1. An initial inspection of the pipeline work site shall be conducted prior to performing any diving operations.

4.2. Gas meters shall be set up in four locations on the DSV to detect any gas levels that are beyond the allowable threshold.

4.3. A full inspection of the pipeline leak site shall be conducted daily to determine the safety of the site before diving operations commence.

4.4. All non-essential personnel shall be removed from the dive control and work site during diving operations.

5.0 Conduct Diver Recovery Drill

5.1. All participants shall be notified of diver recovery drill demonstration including the following:

a. *DSV Shamrock* Wheelhouse
b. AMI HSE Personnel
c. Hilcorp Alaska HSE Personnel

5.2. The compliant Decompression Dive Chamber (DDC), located on the Shamrock shall be the final destination for the patient in the emergency drill.

5.3. Conclusion of the diver recovery drill shall be determined by the AMI supervisor and Hilcorp HSE Representative to discuss performance participants.

6.0 Location of Pipeline at Leak Site

6.1. Conduct pre-dive safety meeting

6.2. Initiate flammable gas precautions on board vessel.

6.3. Verify safe access to the pipeline before diving commences.

6.4. DSV to have pipeline leak repair materials onboard.

6.5. Dive Supervisor and vessel captain analyze location of gas bubbles in relation to the tide velocity and direction with use of Doppler Current Profiler.

6.6. Maintain a flow of gas at 10 PSI over bottom pressure to protect diver while approaching the pipeline leak.

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6.7. Using the visual gas plume, wind and current direction, calculate a drop position for the diver down weight. This will be approximately 50 ft. up current from the leak location.
6.8. When current drops below 2 knots, drop the diver weight and prepare diver for entering the water.
6.9. Diver to initially search 10 ft. up current from the weight then the weight shall be dragged slowly down current until pipeline is located.
6.10. When the pipeline is located the 3/8-inch manila line is plumbed up and tied to the pipeline, a GPS coordinate is recorded and the weight is removed to the surface.
6.11. A permanent 3/4-inch Polypropylene line is sent down the weight line and shackled to the pipeline.
6.12. The 3/8-inch manila line is removed to the surface.
6.13. The diver returns to the surface and enters the decompression chamber.
6.14. The 3/4-inch Polypropylene line is marked with buoy and set up for next tide.

7.0 Investigation and Inspection

7.1. Pick up the buoys onto the DSV when tide drops below 1.5 to 2 knots.
7.2. The 3/4-inch buoy line is faired through the A-frame sheave and put on the deck mounted air tugger.
7.3. At 1 knot current velocity the diver descends the down line to the pipeline.
7.4. With the DSV remaining in position vertical over the downline, the diver inspects the pipeline until he finds the gas leak. The diver reports the scour under the pipeline for 20 ft. both directions from the leak location. Additionally, the diver reports on the external condition of the pipeline. Field joints shall be identified in the inspection location.
7.5. The diver shall be careful not to place his body parts over the gas plume as it may cause an uncontrolled ascent to the surface resulting in injury. Additionally, the diver should not place his diving helmet directly into the plume as gas could enter the helmet.
7.6. After locating and inspecting the pipeline around the leak the diver shall move the downline 3 ft. from the gas leak thus allowing fast access to the work site.
7.7. The gas volume shall be reduced to a level that will not affect the repair operations.
7.8. The diver shall inspect the gas leak to determine the source and amount of excavation that is needed to conduct a repair.
7.9. A black-water camera shall be used to inspect the leak location to determine the root cause of the leak. This information shall be used in the repair plan.
7.10 Non-destructive Examination shall be utilized to determine the structural integrity of the pipeline and provide guidance on remediation.

8.0 Temporary or Permanent Repair (dependent on investigation and work conditions)

8.1. Utilizing the information from the inspection, determine if the leak is from a pipe wall failure.
8.2. Excavate access around the failed pipe section by hand or water jet with the Cavi-blaster unit until it is safe to proceed with repair. The area jetted out must be 2 ft. on each side and at least 2 ft. under the pipeline.

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8.3 Pipeline's surface will be prepped utilizing hydraulic and hand tools to an acceptable condition in order to install the temporary or permanent repair.

8.4 If a clamp is deemed as the proper repair methodology, a clamp with the correct size and pressure rating will be utilized.

8.5 Visually inspect all stud bolts for damage, insure nuts can be run by hand, and rig hardware and tools for deployment to diver.

8.6 Clamp will be properly rigged in such a way to ensure that the clamp remains open until it is gently placed in position on the pipeline. Test lift the clamp according to plans.

8.7 Adjust the pressure and torque settings on the hydraulic impact wrench and compile necessary hardware for installation.

8.8. Proceed to install the clamp on the pipeline by lowering the clamp to designate repair site with guidance from diver. Diver will lower the clamp into position utilizing guide ropes centered over failure.

8.9. Clamp will be inspected to ensure proper fitting. Diver will take caution in keeping head out of direct line of gas seepage.

8.10. Bolts will be installed in pattern to assure even tightening on pipeline. Once the clamp is loosely secured to the pipeline, Diver will rotate the clamp 90 degrees to make nuts more accessible for tightening.

8.11. Diver will torque nuts to specified rating utilizing the pre-set hydraulic impact wrench.

9.0 Repair Completion

9.1. Diver will perform visual inspection of installed clamp and confirm that clamp is fully seated and no gas is escaping.

9.2. Diver shall install an approved corrosion protection wrap to the affected areas of coating that were removed during investigation and clamp preparation.

9.3. The pipeline will be stabilized utilizing bags will a sand and cement mix as specified by owners.

9.4. Upon Completion of clamp installation all rigging shall be removed from site.

10 Demobilization

10.1. Upon notification from the Client the dive support vessel shall return to port in Homer and the tools/equipment shall be transported back to Anchorage.

10.2. All Diving personnel shall disembark the DSV either at OSK dock or at Homer for return to American Marine warehouse in Anchorage.

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Planned Working Depths and Bottom Time

- Navy Rev. 7 Dive tables will be used.
- Water depths for this project are expected to be no deeper than 100 FSW.
- The dive team will be conducting No Decompression dives, and may elect to do in-water decompression if needed.
- No planned dive shall go into the exceptional exposure tables unless in an emergency.
- The below is taken from US Navy Dive Manual Rev. 7, Air Decompression:

Table 9-7. *No-Decompression Limits and Repetitive Group Designators for No-Decompression Air Dives.*

Depth (fsw)	No-Stop Limit	Repetitive Group Designation															
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
10	Unlimited	57	101	158	245	426	*										
15	Unlimited	36	60	88	121	163	217	297	449	*							
20	Unlimited	26	43	61	82	106	133	165	205	256	330	461	*				
25	1102	20	33	47	62	78	97	117	140	166	198	236	285	354	469	992	1102
30	371	17	27	38	50	62	76	91	107	125	145	167	193	223	260	307	371
35	232	14	23	32	42	52	63	74	87	100	115	131	148	168	190	215	232
40	163	12	20	27	36	44	53	63	73	84	95	108	121	135	151	163	
45	125	11	17	24	31	39	46	55	63	72	82	92	102	114	125		
50	92	9	15	21	28	34	41	48	56	63	71	80	89	92			
55	74	8	14	19	25	31	37	43	50	56	63	71	74				
60	63	7	12	17	22	28	33	39	45	51	57	63					
70	48	6	10	14	19	23	28	32	37	42	47	48					
80	39	5	9	12	16	20	24	28	32	36	39						
90	33	4	7	11	14	17	21	24	28	31	33						
100	25	4	6	9	12	15	18	21	25								
110	20	3	6	8	11	14	16	19	20								
120	15	3	5	7	10	12	15										
130	12	2	4	6	9	11	12										
140	10	2	4	6	8	10											
150	8		3	5	7	8											
160	7		3	5	6	7											
170	6			4	6												
180	6			4	5	6											
190	5			3	5												

* Highest repetitive group that can be achieved at this depth regardless of bottom time.

- A Dive profile with diver's name, date, left surface time, reached surface time, depth of dive, and location will be kept on site.
- Surface intervals between dives, breathing medium, type of equipment used, RNT group designation, and durations of any unscheduled decompression stops, with date of last dive will be included.
- Any uncontrollable circumstance that should arise such as threatening weather, water flows, problematic conditions and/or situations will constitute an immediate abort of dive operations.

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Proximity to DDC After Dive Ops

The **Hilcorp MGS Pipeline Leak Investigation and Repair** Project Planning will take into consideration Proximity to Deck Decompression post dive operations for planning and support requirements for No Decompression and Decompression Dive for after operational shift support requirements.

No Decompression requirements will require diver access and vessel transport for a one hour post dive window.

Decompression dive requirements will review option to have diver, DMT and supervisor overnight on the *Shamrock* for coverage requirement option. Contact information for 24-hour vessel transportation support from shore to barge will be required.

Chamber Proximity Comparison Chart

Source	No-Decompression Dive	Decompression Dive
DMAC-22	Diver to remain with in 20 min of a chamber for 1hr post dive	Diver to remain with in 20 min travel of a chamber for 4hr post dive and with in 2hr travel of a chamber until 12 hr post dive.
USN Rev 7 Dive Manual	Diver to remain with in 6hr travel time of a chamber for 12hr	Diver to remain with in 5min travel of chamber for 1hr and with in 6hr travel for 12hr

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Sea State and Ice/Extreme Weather Restrictions

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Sea State Restrictions

Sea state restrictions that may require suspending dive operations:
- Max 3'-5' seas
- Max 20 knot winds, and/or
- Max 1.0 knots current (reference chart below)

Note: It is impossible to predict safety and relative conditions, even under these limits. Identifying restrictions and/or hazards imposed by certain sea states and/or weather conditions is affected by many variable factors. The proposed sea state limits above should be applied with a degree of flexibility; taking account of diver feedback and operational requirements.

- Unsafe diving conditions can still occur within these proposed sea state limitations.

- *** If a representative of Hilcorp shuts down diving operations for any reason, including those that occur within the proposed sea state limits for diving above, AMI will continue to bill the project at the quoted full rate(s).

- It should also be noted that the Diving Supervisor has a legal responsibility for the safety of the diving operation, and will make final call on initiating dive operations. **All persons on job have Stop Work Authority.**

Currents:

Per IMCA D-014 International Code of Practice for Offshore Diving Section 7.4 Environmental Conditions, and AODC 047 Effects of Underwater Current:

Effects of Current Conditions on Diving Operations:

Current (Knots)	0.0	0.8	1.0	1.2	1.5	1.8	2.0 & Beyond
SURF SUPPLY IN MID WATER	Normal	Observation	* NB 1	** NB 2			
SURF SUPPLY ON BOTTOM	Normal	Light	Observation	* NB 1	** NB 2		
BELL OR WET BELL IN MID WATER	Normal work		Light	Observation	* NB 1	** NB 2	
BELL OR WET BELL ON BOTTOM	Normal work			Light	Observation	* NB 1	** NB 2

Notes:
1. NB 1 – Diving by means of this method in these currents should not be a routine operation. The Diving Supervisor should consult with the divers involved and any other person he judges necessary about the best way to conduct such an operation.
2. NB 2 – Diving by means of this method in these currents should not be considered unless the operation has been preplanned taking account of the presence of high current from the early stages of the project. Special solutions involving equipment techniques and procedures should have been evolved to overcome – or protect the diver from – the effects of currents and to provide contingencies for foreseeable emergencies.
3. AMI will be diving Surface Supplied, Mid-water per the table above.

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Ice and Extreme Weather Conditions

The master is ultimately responsible for the safe operation of their vessel at all times. Adherence to appropriate risk mitigation in accordance with project planning and duration, current clear water, current ice conditions, forecasts and collective risk assessments representing a culmination of best practices for mitigating risk to life, property, and the environment.

Vessel transit is based on a number of factors, to include: observed and forecast severe sub-freezing temperatures, aerial observations, information and analysis provided by NOAA, SWAPA, and Cook Inlet maritime operators.

Project planning procedures demonstrate forehandedness on the part of the master and is in keeping with prudent seamanship. However, it is the master's responsibility to take all necessary steps to effectively mitigate risk in all circumstances.

The master shall ensure proper operation of all vessel machinery and systems

The master shall ensure the vessel crew is equipped with adequate personal protection suitable for cold weather during deck operations.

1.0 Introduction

1.1 The winter operational environment in Cook Inlet is demanding on vessels and crews.
1.2 Transit from Homer Harbor to project site is estimated at 16 to 18 hours of exposed travel to get to the jobsite and return transit estimated at over 20 hours to Homer Harbor.
1.3 Traditional anchorages are not accessible due to ice coming out of rivers and collecting in the slower moving water near shore.

2.0 Monitoring the Site for Mobilization

2.1 Continuous monitoring has taken place with ice condition updates sent out from platform, along with national weather service NWS forecast.

3.0 Additional site conditions of Concern.

3.1 With any wind, icing from spray and from the fenders dragging in the water is a concern with the *DSV Shamrock*'s low freeboard.

4.0 Allowable Site Conditions to Proceed. Conditions to be monitored and updated daily.

4.1 Temperature at Site
4.2 Operational Temperature Limits. 20 to 25 degrees F.
4.3 Wind Velocity: Less than 15 knots for seven (7) day window.
4.4 Site Ice Conditions: Will be monitored daily for safe operations. Go/No-Go decisions will be made after consultation between AMI and Hilcorp management. The following methods will be implemented to monitor ice conditions:
  4.4.1. The DSV master will monitor ice forecasts through the NOAA NWS Alaska Sea Ice Program (ASIP) throughout the day.
  4.4.2. Harley Marine tugs *Bob Franco* and *Millennium Star* (masters) at Tesoro Dock will be reporting on current conditions throughout the day.
  4.4.3. Flyover updates from Company aircraft will provide local ice, sea state and weather condition updates.
  4.4.4. Operator on Platform A will provide visual monitoring.

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Project Personnel

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Project Personnel

Training and Compliance:

- Current annual dive physicals documented per ADCI CS Rev 6.2
- US DOT PHMSA Drug Screen
- Current First Aid Certification
- Current Cardiopulmonary Resuscitation (CPR) Certification
- Current Emergency Oxygen Provider Certification
- Current ADCI Certification Cards
- BOEMRE SEMS II Orientation Training for Offshore Oil and Gas Personnel
- Signed AMI DOPSPM (Dive Manual) Rev. 8 (2014) Compliance Acknowledgement Form
- Signed AMI Drug and Alcohol Policy Compliance Acknowledgement Form
- Signed AMI SEA Watch Observation Program Compliance Acknowledgement Form

Vessel Crew

1. Vessel Captain . . . . . .
2. Deckhand / Cook. . . . . .
3. Mechanic Engineer / First Mate. . . . . .

Dive Team Members

1. Senior Project Manager. . . . . .
2. Dive Supervisor. . . . . .
3. Diver . . . . . .
4. Diver . . . . . .
5. Diver . . . . . .
6. Tender . . . . . .
7. Tender . . . . . .

Responsibilities

All individual responsibilities will be referenced in detail within the AMI Diving Operations Procedures and Safe Practices Manual, Rev. 8 (July 2014) presented on the following page:

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1.0 RESPONSIBILITY

1.1 Dive Supervisor – The duties of the supervisor include but are not limited to:

1.1.1 Development and execution of the Site Specific Procedure (SSP) and all required HSE documents.
1.1.2 Will review this SSP with entire crew and any other personnel involved prior to commencing the work described herein.
1.1.3 Ensure the lay of the dive hose is monitored at all times while a diver is in the water.
1.1.4 Ensure the dive crew is fully briefed on procedures to cope with any delay that may arise while recovering the diver through the air gap.
1.1.5 Ensure all personnel involved with diving operations are trained in accordance to this SSP.
1.1.6 Gather all information from Co-Rep pertaining to the subsea work area.

1.2 Diver – the duties of divers should include but not limited to:

1.2.1 Will ensure personal familiarity with this procedure and will perform all underwater tasks safely and in an efficient manner.
1.2.2 Shall remain constantly aware of their dive hose positioning.
1.2.3 Inform dive supervisor of any subsea obstructions that my cause a hose fouling hazard.
1.2.4 Be prepared to leave bottom immediately upon notice to do so by the radio operator.

1.3 Standby Diver – the duties of standby divers include but are not limited to:

1.3.1 Responsible for getting to and rendering aid to stricken or otherwise needy Divers as rapidly as is safely possible.
1.3.2 Shall keep abreast of diver's work progress and understand task to be performed.
1.3.3 Communicate to the Dive Supervisor any observed or anticipated impediments to their rapid and safe deployment.
1.3.4 Monitor weather and notify Supervisor if diminishing.

1.4 Tender – for this job all team members, including those who are temporarily carrying out the duties of a tender are qualified divers and will also operate as divers. Their duties include but are not limited to:

1.4.1 Wear required PPE.
1.4.2 Experienced and competent in Dressing Standby diver out
1.4.3 Tending the diver's umbilical
1.4.4 Communicating with topside dive crew
1.4.5 Assisting diver in and out of dive stage
1.4.6 Assisting standby diver in and out of dive stage
1.4.7 Monitor weather and notify Supervisor if diminishing.
1.4.8 Monitor for vessel traffic in the area and notify Dive Supervisor of concerns if observed.
1.4.9 Monitor for any crane activity or other types of work that is taking place that could pose a potential unsafe condition for the diver or those working on the DSV or barge if applicable.
1.4.10 Assist with deck operations as requested/assigned by Dive Supervisor.

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AMI Emergency Management Plan

AMERICAN MARINE INTERNATIONAL

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Emergency Management Plan — Cook Inlet / Nikiski

1. For any non diving emergency:

- AMI will follow the Emergency Response Plans (ERPs) already established by Hilcorp
- AMI Operations Safety & Compliance Manager contact:

2. For any Commercial Diving, Hyperbaric, or Pressure-related emergency condition:

a. Decompression chamber will be on site and Dive Supervisor will follow AMI emergency procedures through initial treatment.

b. AMI Emergency Medical Technicians (EMTs) / Dive Medical Technicians (DMTs) on board.

c. Dive Supv./AMI DMT will contact On Duty Diving Medical Physician at West Jefferson Industrial Medicine (504) 433-5070.

Primary On-board EMT/DMT for duration of Job: _____

DMT NBHDMT – AK State / National Registry #: DMT# AKEMT#

Contact Number: _____

Alternate On-board EMT/DMT for duration of Job: _____

DMT NBHDMT – AK State / National Registry #: DMT# AKEMT#

Contact Number: _____

d. **Company-appointed Diving Medical Officer (DMO): to be identified**

Primary: answering service 24/7

Secondary: Physician Specific

e. **Company Safety (HSSEQ) Department contact:**

Primary: Operations Safety & Compliance Manager

Alternate: Alaska Regional Manager

f. **Company Management contact:** Primary – Vice President

3. Chamber Facilities in vicinity of evacuation for any follow up treatment deemed necessary by DMO.

- Ensure hospital can accommodate victim, advise Air Ambulance which hospital patient needs to go to.
- DMT should accompany IP along with dive profiles and treatment records for hyperbaric physician.

PRIMARY FACILITY

Primary Hospital / Facility Virginia Mason Seattle Main Campus

Street Address 1100 Ninth Avenue

City Seattle State WA Zip 98101

Main Number (206) 223-6600 or Toll Free: (888) 862-2737

Emergency Receiving Number (360) 417-7000 or 911 Chamber Number 3

Facility called on 2/28/17 (date) by Operations Safety & Compliance Manager (name).

Verified in operational condition ☑ yes ☐ no Able to accommodate up to 6 Atmospheres of Pressure.

ALTERNATE

Alternate Hospital / Facility Providence Hospital

Street Address 3200 Providence Drive #248

City Anchorage State AK Zip 99508

Main Number 907-562-2211 or 911

Emergency Receiving Number _____ Chamber Number NO CHAMBER

Facility called on 2/28/17 (date) by Operations Safety & Compliance Manager (name).

Verified in operational condition ☐ yes ☐ no Able to accommodate up to _____ Atmospheres of Pressure.

4. If other numbers are required, these will be determined during pre-job meeting.

Reviewed and Approved by: _____ Date: _____

Reviewed and Approved by: _____ Date: _____

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Emergency Phone List

ANCHORAGE & COOK INLET OPERATIONS 911

Nikiski Fire Department (Non-Emergency) . . . . . (907) 776-6402
Soldotna Public Safety Communications Center . . . . . (907) 262-4453
(Alaska State Trooper Non-Emergency)
Kenai Peninsula Office of Emergency Management . . . . . (907) 262-4910
Port of Anchorage – Facility Security . . . . . (907) 343-6232
USCG Rescue Coordination Center (Emergency) . . . . . (907) 229-8203
US Coast Guard MSO, Anchorage . . . . . (907) 271-6700
Alaska Rescue Coordination Center (AKRCC), Elmendorf AFB . (907) 551-7230
CISPRI – Cook Inlet Spill Prevention & Response, Inc., Kenai . . (907) 776-5129
Alaska Chadux Corporation . . . . . (907) 348-2365
Providence Hospital ER, Anchorage . . . . . (907) 212-3111
Alaska Regional Hospital ER, Anchorage . . . . . (907) 264-1224
Central Peninsula Hospital, Soldotna . . . . . (907) 714-4404
Providence Health & Services in Valdez . . . . . (907) 835-2249
LifeFlight Air Ambulance . . . . . (907) 264-2388
LifeMed Alaska, Anchorage 24 Hour Medevac Service . . . . . (800) 478-5433
Dive Support Vessel (DSV) Shamrock . . . . . (907) 240-6752

DIVE PHYSICIANS & HYPERBARIC MEDICINE SPECIALISTS:

Hyperbaric Physician
Office – 24/7 answering service . . . . . (504) 433-5070
Mobile phone in case of emergencies . . . . . (504) 234-2012

Divers Alert Network (DAN) . . . . . (919) 684-9111

Virginia Mason Hospital & Medical Center, Seattle WA,
Emergency Room . . . . . (206) 583-6483
Virginia Mason Hospital, Center for Hyperbaric Medicine . . . . . (206) 583-6543

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Incident Management Plan

Overview

Minor injuries incurred on the job will be handled by the First Aid trained American Marine International (AMI) marine crew and the AMI Dive Team. More serious injuries will receive immediate care, and advanced emergency medical care from the EMT/DMT trained members of the AMI Dive Team.

Additional emergency services will be engaged, as needed, using the emergency contact numbers listed previously. Initial stabilization and treatment of dive related conditions will occur in the Hyperbaric Chamber staged on-site onboard the DSV Shamrock utilizing AMI EMTs and Dive Medics who will function under the American Marine International – Medical Control System. Through Medcall assist/West Jefferson Medical group, the AMI emergency medical providers will stabilize and package the injured/ill person for transport using a Stokes Litter or equivalent. The packaged injured person will be transferred to an offshore installation/platform using the installation crane and a Billy Pugh Personnel Transport Basket. The Stokes Litter will be secured to the Billy Pugh prior to transfer between the *DSV Shamrock* and the offshore installation. The patient will be transferred to the Hilcorp Alaska contracted helicopter using the installation helideck. For situations and conditions requiring immediate extraction of an injured person from the DSV Shamrock, the Coast Guard will be utilized since medevac helicopters do not possess hoisting capability.

If hospitalization is required, the American Marine International person in charge (PIC) will coordinate with the Client representative and the receiving hospital in Anchorage, to arrange air medical evacuation (medevac). The AMI HSE Manager will be notified. If air evacuation air ambulance services are not available, or inclement weather prohibits air medical evacuation, a marine vessel will be utilized as a fallback emergency evacuation method, with an AMI EMT/DMT accompanying the patient during transport to an appropriate hospital.

Communications Systems and Capability

In recognition of the value of good communications capability during routine operations, and of how critical communications are to emergency operations, AMI strives for redundancy of modes of communication and power supply for all our marine operations. In international waters this may be a full GMDSS array per “Sea Area” requirements. For coastal operations, VHF Marine, VHF Aviation, and Satellite Phone (SatPhone), and for remote inland areas, Satellite Phone and High Frequency (HF) radio. Effective Medical Emergency Response in remote areas depends on a good communications link with “Medical Control.” AMI has radio to phone patch capability through our Medevac Provider’s Emergency Communications Center, as well as redundancy of phone lines, communication modes, and backup power, in addition to access to our Medevac Provider’s sophisticated cutting-edge flight tracking program.

American Marine International uses a Tiered Medical Response System which consists of the following:

Tier 1 – Basic Life Support (BLS), if indicated, is provided either immediately or in any event, in four (4) minutes or less, including CPR, airway management, and defibrillation. American Marine International (AMI) first responders are trained to ensure scene safety (address operational hazards, hazardous materials and arctic environment issues) and to rapidly assess the injured person to determine if Advanced Life Support (ALS) is needed, and if Medevac will be required that either the AMI Medevac Provider, or Hilcorp Alaska’s Medevac Provider (if operating under the Hilcorp Alaska medical response system), is notified immediately in order to reduce overall response and transport times.

Tier 2 – Advanced Life Support (ALS) is provided, if indicated, within 6-10 minutes by Medical First Responders and Emergency Medical Technicians (EMTs) trained according to the U.S. DOT standard and certified to function at a corresponding level in the State of Alaska. Emergency medical responders providing care for dive related illness (decompression illness-DCI), or injuries incurred during a dive operation, are also trained as Dive Medical Technicians (DMTs) and function under the direct Medical Control of a physician trained in Dive Medicine and experienced in hyperbaric treatment for dive related emergencies.

Tier 3 – Medical Evacuation (Medevac) is provided if indicated following in situ (in place) stabilization and packaging of the injured person(s). Medical Evacuation (Medevac) will be conducted by air or marine transport means, as appropriate, for the nature of the illness or injury, and given the operational and environmental conditions. Medevac as a result of dive related illness or injury will be conducted “under pressure” in a mobile hyperbaric chamber if indicated. Air medical evacuation will be utilized only after considering the possible contraindications of altitude.

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Emergency and Contingency Plans

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Diver Loss of Air Supply

REVIEW STATUS						
Rev	Date	Description	By	Checked	Approved	Client

1.0 PURPOSE

1.1. The following plan is a project specific procedure developed for the Hilcorp MGS Pipeline Leak Investigation and Repair Project. American Marine International (AMI) developed this plan in the event the diver loses supplied air during a dive, regardless of whether this results from loss of air supply from the dive compressor, or the dive umbilical is crimped or severed.

2.0 OVERVIEW

2.1 All systems shall be thoroughly tested and vetted as specified in the ADCI Consensus Standards 6.2 audit form prior to deployment for a project. A dive system certification package, verifying dive equipment component status, shall be shipped with every dive spread.

2.2 Equipment comprising the dive spread is to be inspected onsite per the AMI and manufacturer operational checklists.

3.0 CONTINGENCY PLAN

3.1. Loss of Breathing Media

3.1.1. Ensure reserve gas supply (RGS) bottles are checked, topped off if needed, and verified in writing within 30-minutes before the commencement of the dive.

3.1.2. The supervisor will inform the diver (or vise versa) to initiate RGS to the helmet.

3.1.3. If use of the free-flow valve is not necessary once the RGS is initiated – do not do so – as this will deplete the RGS cylinder rapidly!

3.1.4. Supervisor initiates secondary breathing supply to the diver and checks gauges and system in line to the diver.

3.1.5. Supervisor initiates purge to the pneumo hose and informs the diver to insert pneumo hose into helmet. Pneumo hose should be purged when diver reaches bottom, and kept trickling to ensure it stays free of water.

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3.1.6. Supervisor to alert and launch the standby diver immediately, if deemed necessary.
3.1.7. Diver inserts pneumo hose inside helmet.
3.1.8. Supervisor instructs the diver to immediately return to the dive stage or down line.
3.1.9. Abort the dive and follow proper decompression procedure.
3.1.10. If topside secondary or primary breathing medium is re-established, inform the diver to shut off reserve gas supply (RGS) and continue with abort procedure.
3.1.11. Incident Report, conduct incident investigation & perform root cause analysis (RCA).

3.2 Severance of Diver's Hose Group – Gas Hose Only

3.2.1. Ensure reserve gas supply (RGS) bottles are checked, topped off if needed, and verified in writing within 30-minutes before the commencement of the dive.
3.2.2. Diver activates reserve gas supply (RGS).
3.2.3. If use of the steady-flow valve is not necessary once the reserve gas supply (RGS) is initiated – do not do so – as this will deplete the RGS cylinder rapidly!
3.2.4. Supervisor to alert standby diver and ready for deployment.
3.2.5. Diver shall activate RGS if not already activated, immediately return to the down-line, and return to dive stage.
3.2.6. Terminate dive and follow proper decompression procedure.
3.2.7. If standby diver is deployed this will require the use of the secondary stage as outlined in the following Section 3.3
3.2.8. Incident Report, conduct incident investigation & perform root cause analysis (RCA).

3.3 Severance of Complete Umbilical Group

3.3.1 Ensure reserve gas supply (RGS) bottles are checked, topped off if needed, and verified in writing within 30-minutes before the commencement of the dive.
3.3.2 Complete severance of the diving umbilical is a very serious situation, only general guidelines can be given here.
3.3.3 Diver activates reserve gas supply (RGS) bottle and returns to the downline and begins return to the dive stage where additional HP reserve air cylinders are located.
3.3.4 If use of the free-flow valve is not necessary once the reserve gas supply (RGS) is initiated – do not do so – as this will deplete the RGS cylinder rapidly!
3.3.5 Supervisor to alert standby diver who will enter the water immediately.
3.3.6 Supervisor shall ensure air flow is started to all pneumo hoses.
3.3.7 Standby diver attaches himself to the diver and inserts his pneumo hose into the divers neck dam / helmet. Diver may already be back at the primary dive stage and situation stabilized with use of HP emergency cylinders located on primary dive stage.
3.3.8 Diver and Standby Diver return to surface via the primary or secondary wet-bell.
3.3.9 Terminate dive and follow proper decompression procedure.
3.3.10 Incident Report, conduct incident investigation & perform root cause analysis (RCA).

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Chamber Loss of Breathing Air Supply

REVIEW STATUS						
Rev	Date	Description	By	Checked	Approved	Client

1.0 Purpose

American Marine International (AMI) developed the following plan, which is a case-specific procedure developed for the Hilcorp MGS Pipeline Leak Investigation & Repair Project. This contingency plan was developed as a response in the event of a loss of air supply to the chamber due to malfunction in the air supply system.

2.0 Overview

2.1 One Diesel 5120 LP Compressor and One 3 bottle rack and one 2 bottle rack of HP air shall be utilized on the DSV Shamrock in the air supply system.

2.2 The diesel 5120 air compressor shall be used for divers main air supply. This compressor will also be utilized as air supply to the DDC.

2.3 The diesel 5120 air compressor shall be used as the primary supply for DDC.

2.4 The electric HP air compressor (26.4 CFM) shall be used for charging the HP bottle banks.

3.0 Contingency Plan

3.1 The dive supervisor will be notified of the situation.

3.2 Immediately switch from main air supply to secondary air supply (Chamber and diver) while the primary air supply is being restored.

3.3 The standby air supply to the chamber (HP air bank) will be utilized.

3.4 The chamber operator will refrain from all unnecessary chamber ventilation while the diver's backup air supply is open to the chambers.

3.5 The supervisor will determine the problem causing the chamber air loss and direct repair operations.

3.6 In the event of compressor or HP air bank malfunction, diving operations shall be suspended and shall not resume until repairs are performed.

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Job Hazard Analysis
&
Risk Assessment

AMERICAN MARINE INTERNATIONAL	**JOB NAME or DESCRIPTION:** Hilcorp MGS Pipeline Leak Investigation & Repair Dive Operations	**JHA/RA NUMBER:** AMI-MGS Pipeline-General Diving Page 1 of 6	**DATE:** Feb. 28, 2017	**NEW** ☒
JOB HAZARD ANALYSIS & RISK ASSESSMENT	**TITLE OF PERSON WHO DOES JOB:** Diver and Diver-Tender Dive Supervisor, Boat Capt.	**SUPERVISOR:**	**PERMIT TO WORK REQUIRED:** YES ■ NO ❑	
ANALYSIS PERFOMED BY: (Safety & Compliance Manager) and/or Dive Crew	**LOCATION:** Middle Ground Shoal (MGS) Cook Inlet, Alaska	**DEPARTMENT:** AMI Diving/ Construction AMI HSSEQ Department	**REVIEWED/APPROVED BY:**	

RESOURCES AT RISK CODES: **A**= ASSETS **E** = ENVIRONMENT **P** = PEOPLE	**HAZARD SEVERITY CODES:** **1**-slight, **2**-minor, **3**-serious, **4**-major, **5**-catastrophic	**PROBABILITY CODES:** **1**-negligible, **2**-low, **3**-medium, **4**-high, **5**-frequent
Resource at Risk Without Mitigation: **People and Assets**	**Hazard Severity Without Mitigation** **5 (Catastrophic)**	**Probability of Occurrence Without Mitigation** **4 (High)**
Risk Class Without Mitigation = Risk Class 20 **Note: Hazard Severity X Probability = Risk Class** **(Refer to Project RA-HAZID)**		
Resource at Risk With Mitigation: **People and Assets**	**Hazard Severity With Mitigation** **5 (Catastrophic) - If Event Were to Occur**	**Probability of Occurrence With Mitigation** **2 (High)**
Probability With Mitigation = Risk Class 10 **Note: Hazard Severity X Probability = Risk Class** **(Refer to Project RA-HAZID)**		

APPROVALS

Name	Signature	Company	Position	Date

Include all Workers in Development and/or Review of JHA/RA Add Additional Pages If Required Conduct Pre-Job Safety Meeting Before Operation

AMERICAN MARINE INTERNATIONAL	**JOB NAME or DESCRIPTION:** **Hilcorp MGS Pipeline Leak Investigation & Repair** **Dive Operations**	**JHA/RA NUMBER:** **AMI-MGS Pipeline-General Diving** **Page 2 of 6**	**DATE:** **Feb. 28, 2017**	**NEW** ☒
JOB HAZARD ANALYSIS & RISK ASSESSMENT	**TITLE OF PERSON WHO DOES JOB:** **Diver and Diver-Tender** **Dive Supervisor, Boat Capt.**	**SUPERVISOR:**	**PERMIT TO WORK REQUIRED:** **YES** ■ **NO** ❑	
ANALYSIS PERFOMED BY: **(Safety & Compliance Manager) and/or Dive Crew**	**LOCATION:** **Middle Ground Shoal (MGS)** **Cook Inlet, Alaska**	**DEPARTMENT:** **AMI Diving/ Construction** **AMI HSSEQ Department**	**REVIEWED/APPROVED BY:**	

JOB, TASK, OR OPERATION BROKEN DOWN INTO STEPS	RISK & POTENTIAL HAZARDS FOR EACH STEP	ACTION, PROCEDURE, AND SAFETY EQUIPMENT TO ELIMINATE HAZARDS AND MANAGE RISK
1. Job plan review. Control of Work. Take out Work Permits Ensure no conflict with other Work Permits for other operations. SIMOPs Review Risk Assessment	Failure to follow ATP process. Conflicts with other SIMOPS. Conflicts with other Work Permits Failure to identify all hazards & risks. Failure to complete risk assessment. Failure to mitigate hazards & risks. Potential Differential Pressure hazards.	Complete ATP process. Complete Risk Assessment & Hazard Identification process. Conduct SIMOPs evaluation. Identify conflicts with other permits Ensure Hyperbaric Chamber staged on-site is prepped & service ready. Consider and plan mitigation against Differential Pressure hazards.
2. Pre-Job Toolbox Safety Meeting Job Hazard & Risk Assessment Review of Project RA-HAZID	Best practice necessitates a Pre-Job Safety Meeting with JHRA review prior to beginning the job / operation.	The Pre-Job Toolbox Safety Meeting, to include JHRA review. Review project Risk Assessment & Hazard Identification- RA-HAZID Review marine emergency response plan (ERP). Post contact #s. Review using PFDs anytime working on deck during barge diving ops. If any change, STOP work until corrected.
3. Pre-Dive Meeting Job Task Properly Identified Dive Spread Equipment Checks Review hazards & risks (JHRA)	Job or task not adequately identified. Job hazards/risks not fully understood. SIMOPS of Diving and Lifting. Diving equipment not fully functional. Diving safety critical equipment failure Unsafe sea conditions for men/equip. Environmental impact event. Failure to adjust for adverse weather.	Verify proper functioning of all diving equipment. Diving equipment check to be completed and signed-off. Verify diving safety critical equipment function and redundancy. Ensure proper containment to prevent fluid release to environment. Verify that sea and ice conditions have been evaluated and site is safe. Provisions to monitor weather conditions. Dive Supervisor discretion on job stop due to weather conditions.

AMERICAN MARINE INTERNATIONAL	**JOB NAME or DESCRIPTION:** Hilcorp MGS Pipeline Leak Investigation & Repair Dive Operations	**JHA/RA NUMBER:** AMI-MGS Pipeline-General Diving Page 3 of 6	**DATE:** Feb. 28, 2017	**NEW** ☒ **REVISED**
JOB HAZARD ANALYSIS & RISK ASSESSMENT	**TITLE OF PERSON WHO DOES JOB:** Diver and Diver-Tender Dive Supervisor, Boat Capt.	**SUPERVISOR:**	**PERMIT TO WORK REQUIRED:** YES ■ NO ❑	
ANALYSIS PERFOMED BY: (Safety & Compliance Manager) and/or Dive Crew	**LOCATION:** Middle Ground Shoal (MGS) Cook Inlet, Alaska	**DEPARTMENT:** AMI Diving/ Construction AMI HSSEQ Department	**REVIEWED/APPROVED BY:**	

JOB, TASK, OR OPERATION BROKEN DOWN INTO STEPS	RISK & POTENTIAL HAZARDS FOR EACH STEP	ACTION, PROCEDURE, AND SAFETY EQUIPMENT TO ELIMINATE HAZARDS AND MANAGE RISK
4. Dress Diver In Standby Diver – Dress In Note: Standby Diver to be fully dressed in except for helmet. Helmet should be in close proximity & ready to be donned if necessary.	Diving life support critical equipment failure. Diver hypothermia. Diver entering water without fully functional life support equipment. Diver falling into water without dive helmet properly secured and drowning. Support personnel falling into water and drowning. Primary Diver entering water without Standby-Diver ready to respond to an emergency situation. Hyperbaric Chamber not ready to receive Diver suffering from decompression sickness.	PPE for topside support personnel: Rain Gear, eye protection, gloves. Diving helmet properly secured to suit. Diver's umbilical properly shackled to harness. Bailout-whip properly configured. Ensure barriers in place and diver kept safe distance from water's edge while dressing in. Diver to be adequately tended while dressing in. Personal floatation devices donned and secured. Verify onsite hyperbaric chamber is prepped and ready to receive an injured or ill diver if necessary.
5. Diver Water Ingress	Slip, trip, fall hazard during ingress. Breathing gas flow failure. No contact with diver after ingress. Communication system failure. Hot water system failure. Standby diver not prepared to assist	PPE for topside support personnel: Warm clothes, eye protection and gloves, PFD. Umbilical management so diver does not hang up on umbilical. Tender to assist diver throughout diver ingress. Communications check before and immediately after diver ingress. Abort dive in the event of communication system failure. Verify good breathing gas flow. Verify good hot water delivery and circulation. Standby Diver fully dressed in and ready to react immediately.

AMERICAN MARINE INTERNATIONAL	**JOB NAME or DESCRIPTION:** Hilcorp MGS Pipeline Leak Investigation & Repair Dive Operations	**JHA/RA NUMBER:** AMI-MGS Pipeline-General Diving Page 4 of 6	**DATE:** Feb. 28, 2017	**NEW** ☒ **REVISED**
JOB HAZARD ANALYSIS & RISK ASSESSMENT	**TITLE OF PERSON WHO DOES JOB:** Diver and Diver Tender Dive Supervisor, Boat Capt.	**SUPERVISOR:**	**PERMIT TO WORK REQUIRED:** YES ■ NO ❑	
ANALYSIS PERFOMED BY: (Safety & Compliance Manager) and/or Dive Crew	**LOCATION:** Middle Ground Shoal (MGS) Cook Inlet, Alaska	**DEPARTMENT:** AMI Diving/ Construction AMI HSSEQ Department	**REVIEWED/APPROVED BY:**	

JOB, TASK, OR OPERATION BROKEN DOWN INTO STEPS	RISK & POTENTIAL HAZARDS FOR EACH STEP	ACTION, PROCEDURE, AND SAFETY EQUIPMENT TO ELIMINATE HAZARDS AND MANAGE RISK
6. Diver In-Water Check	Breathing gas delivery system failure. Hot Water delivery system failure. Hot water system delivers over temp Communication system failure.	Diver to complete in-water systems check. Topside support team to complete topside systems check. Dive to be aborted if any of the systems are not fully operational.
7. Locating Pipeline Job Task Properly Identified	Diver getting entangled in propellers. Diver getting injured by drop weight. Diver getting disoriented.	Captain Positions vessel over the top of the target location. Upon signal divers drop weight to the bottom Diver descends weight line to bottom and locates pipeline Diver shall never go under boat during pipeline locating If pipeline is not found during search than the dive is aborted and the returns to the surface and repeats the procedure.
8. Diver Underwater Inspection of Worksite	Breathing gas delivery system failure. Hot Water delivery system failure. Hot water system delivers over temp Communication system failure. Diver injured or becomes unconscious. Diver becomes entangled or trapped.	Topside control maintains constant communication with diver. Standby Diver ready to respond if Diver becomes unresponsive. Standby Diver ready to respond if Diver becomes entangled/trapped.

AMERICAN MARINE INTERNATIONAL	**JOB NAME or DESCRIPTION:** **Hilcorp MGS Pipeline Leak Investigation & Repair** **Dive Operations**	**JHA/RA NUMBER:** **AMI-MGS Pipeline-General Diving** **Page 5 of 5**	**DATE:** **Feb. 28, 2017**	**NEW** ☒ **REVISED**
JOB HAZARD ANALYSIS & RISK ASSESSMENT	**TITLE OF PERSON WHO DOES JOB:** **Diver and Diver-Tender** **Dive Supervisor, Boat Capt.**	**SUPERVISOR:**	**PERMIT TO WORK REQUIRED:** **YES** ■ **NO** ❑	
ANALYSIS PERFOMED BY: **(Safety & Compliance Manager) and/or Dive Crew**	**LOCATION:** **Middle Ground Shoal (MGS)** **Cook Inlet, Alaska**	**DEPARTMENT:** **AMI Diving/ Construction** **AMI HSSEQ Department**	**REVIEWED/APPROVED BY:**	

JOB, TASK, OR OPERATION BROKEN DOWN INTO STEPS	RISK & POTENTIAL HAZARDS FOR EACH STEP	ACTION, PROCEDURE, AND SAFETY EQUIPMENT TO ELIMINATE HAZARDS AND MANAGE RISK
9. Diver Moves to Safe Location as tools or crane loads are deployed	Crush, pinch points Danger of load dropping and pinning the Diver to the bottom. Pinch points & caught between hazards if Diver too close as equip lowered. Load or rigging fouling the umbilical	Diver will be retrieved and, out of water as equipment lowered. Tender shortens umbilical length to keep Diver clear of hazards. Good "Hose Management" by Tender throughout the operation.
10. Diver Change Out	Slip, trip, fall during egress. Diver slips/falls as coming up ladder. Diver hangs on umbilical.	PPE for topside support personnel: Rain Gear, eye protection, gloves, Diver-Tender to support Diver as he ascends and exits ladder. Slack in umbilical so diver does not hang up on umbilical. Diver-tender to assist diver throughout diver egress.

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Support and Reference Documents Table of Contents

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Support and Reference Documents

AMI Supporting Documents

1. American Marine International Diving Operation Procedure & Safe Practices Manual
2. US Navy Diving Manual Revision 7
3. Association of Diving Contractors International Consensus Standards for Commercial Diving and Underwater Operators 6.2
4. Safety Data Sheets (SDS)
5. AMI Project Authorization Documents
6. AMI Vehicle Journey Management
7. AMI Journey Management
8. AMI Change Request MOC
9. AMI Change Request Register MOC
10. AMI Sea Watch
11. AMI HSSE Non-Conformity Notice
12. AMI Blank JHA/RA
13. Training and Compliance
14. Project Risk Assesment and Hazard Identification
15. AMI Writtten Risk Assessment for General Diving
16. Tool Box Meeting Sign-In Sheet
17. Rigging Certificates
18. Load Test Procedure
19. Welding Procedures
20. NDE QC/QA Procedures

Hilcorp Supporting Documents

INSTALLATION PROCEDURE

The Pipe Line Development Co.
PLIDCO International, Inc.

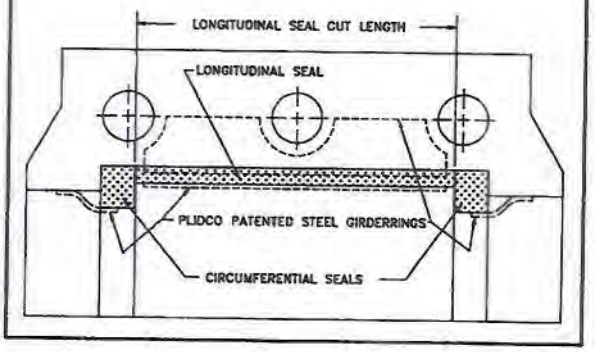
Subject:	Seal Replacement for Split Fittings
Number:	IP-004
Effective Date:	04AUG04
Page:	1 of 2

Listed below is the procedure for replacing the seals in a Plidco split repair fitting. Please contact Plidco with any questions concerning the procedure. A video tape on seal replacement is available on request.

1. Raise the GirderRings (seal retainers) by prying with a wide screwdriver or similar tool being careful not to damage the GirderRings.
2. Strip out all the old seals and remove all foreign matter by scraping or wire brushing. Remove any sharp edges or burrs that may contact the seals.
3. The pre-cut lengths of seals are supplied longer than necessary and will require trimming with a sharp knife. To prevent unraveling, wrap newly cut ends of braided seals with the Teflon tape provided.
4. Determine if the side seal grooves are open style or closed style; see Figure A and Figure B. Open style side seal grooves require the circumferential seals be installed first. Closed style side seal grooves require the side seals be installed first.
5. Replacement seals must be installed with the printed identification number on the seal against the bottom of the groove. If the seal does not have an identification number, the seal must be installed with the narrower side of the rectangular cross section against the bottom of the groove.

FIG. A

OPEN STYLE SIDE SEAL GROOVES

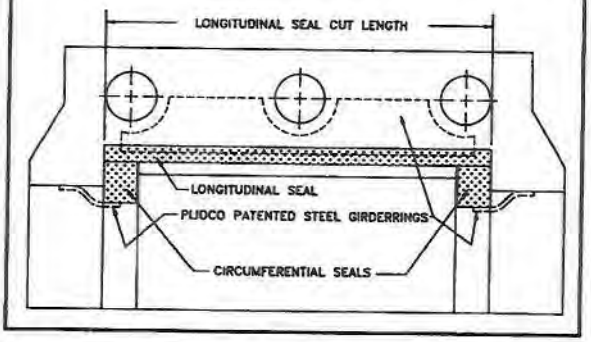


Open Groove Style

6. Install the circumferential seals by firmly pressing the seals into the circumferential grooves. The ends of the circumferential seals must be trimmed so they extend approximately 1/8 inch, ± 1/32 inch, above the machined face. Refer to Figure C. Do not include the thickness of the side GirderRing in this measurement. It is important that a smooth, square cut is achieved.
7. Tap down the circumferential GirderRing to hold the seals in place.
8. Cut the side (longitudinal) seals 1/8 inch, + 1/8 - 0 inch, longer than the distance between the inside edges of the circumferential grooves.

FIG. B

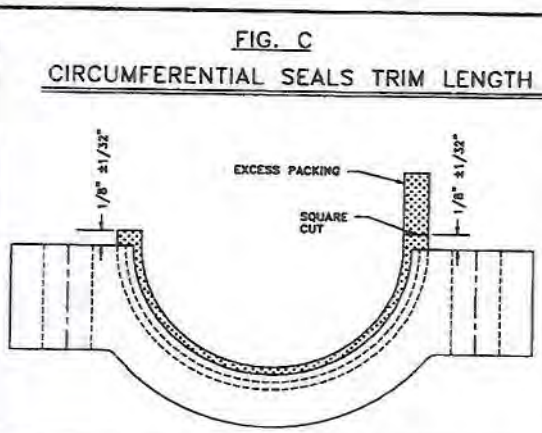
CLOSED STYLE SIDE SEAL GROOVES



9. Install the side seals by firmly pressing the seals into the machined side grooves. The top of the side seals will be approximately 1/8 inch above the machined face of the fitting.

10. Tap down the side GirderRing to hold the seals in place.

FIG. C
CIRCUMFERENTIAL SEALS TRIM LENGTH



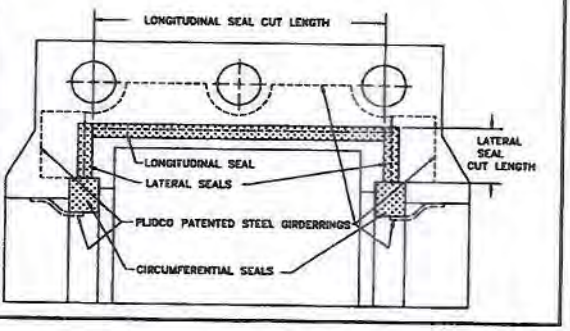
Closed Groove Style

6. Refer to Figure D. If the side seals do not include lateral seals, the longitudinal seals should be cut to the same length, + 1/8 -0 inch, as the length of the longitudinal grooves.
If the side seals include lateral seals, the longitudinal seals should be cut 1/8 inch, + 1/8 - 0 inch, longer than the distance between the inside edges of the lateral grooves. (The longitudinal seal length does not include the width of the lateral grooves.) The lateral seals should be cut to the same length as the lateral grooves, +1/8 - 0 inch. (The lateral seal length includes the width of the longitudinal groove.) Cut as described, the longitudinal seal abuts against the insides of the lateral seals. The seams between the longitudinal and lateral seals do not have to be staggered. The seals for both halves of the fitting are cut the same.

7. Install the side seals first by firmly pressing the seals into the machined side grooves. The top of the side seals will be approximately 1/8 inch above the machined face of the fitting.

8. Tap down the side GirderRing to hold the seals in place.

FIG. D
CLOSED STYLE SIDE SEAL GROOVES
WITH LATERAL GROOVES



9. Install the circumferential seals by firmly pressing the seals into the circumferential grooves. The ends of the circumferential seals must be trimmed so they extend approximately 1/8 inch, ± 1/32 inch, above the machined face. Refer to Figure C. Do not include the thickness of the side GirderRing in this measurement. The ends of the circumferential seals should now be approximately flush with the top of the side seals. It is important that a smooth, square cut is achieved.

10. Tap down the circumferential GirderRing to hold the seals in place.

FIG. A

OPEN STYLE SIDE SEAL GROOVES

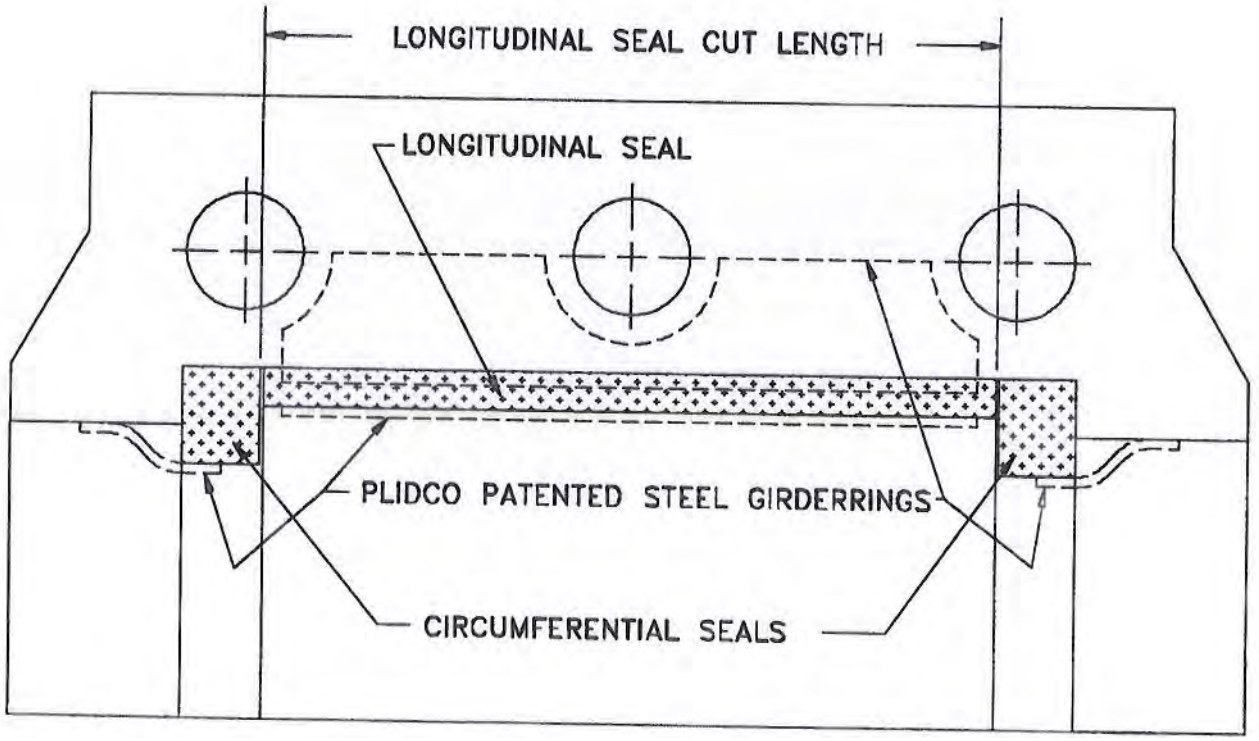


FIG. B

CLOSED STYLE SIDE SEAL GROOVES

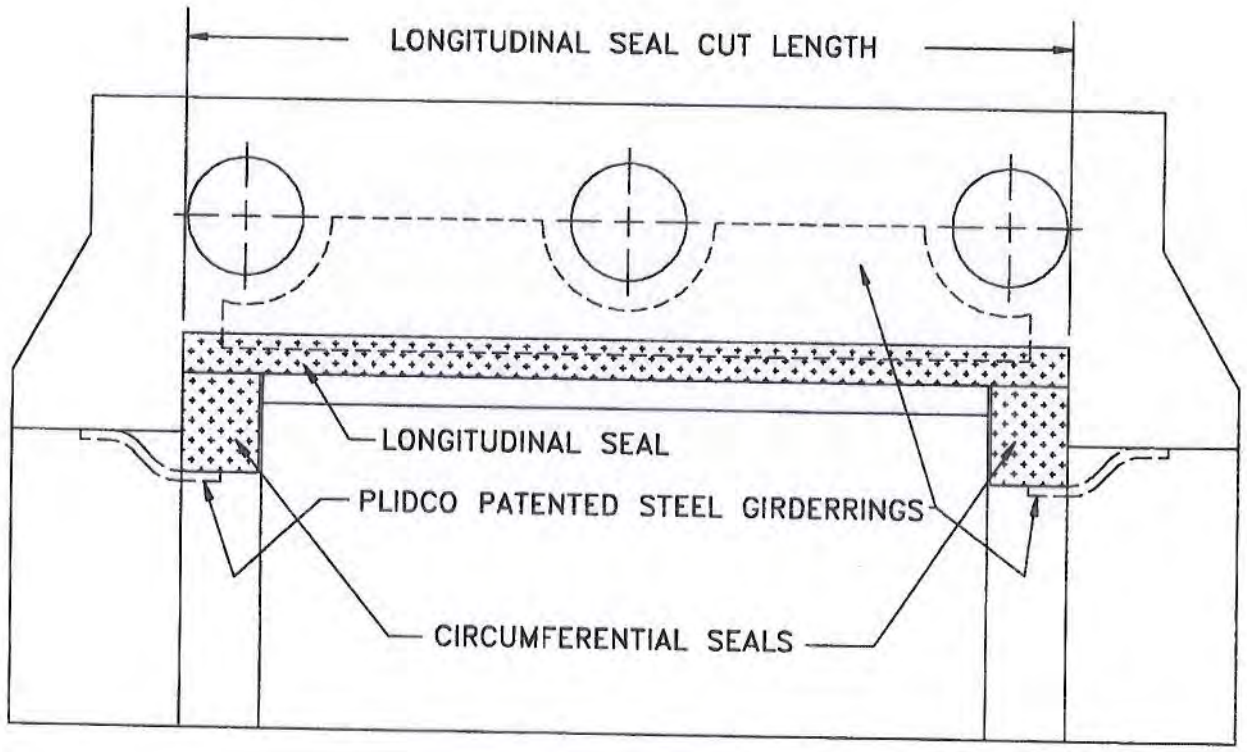


FIG. C

CIRCUMFERENTIAL SEALS TRIM LENGTH

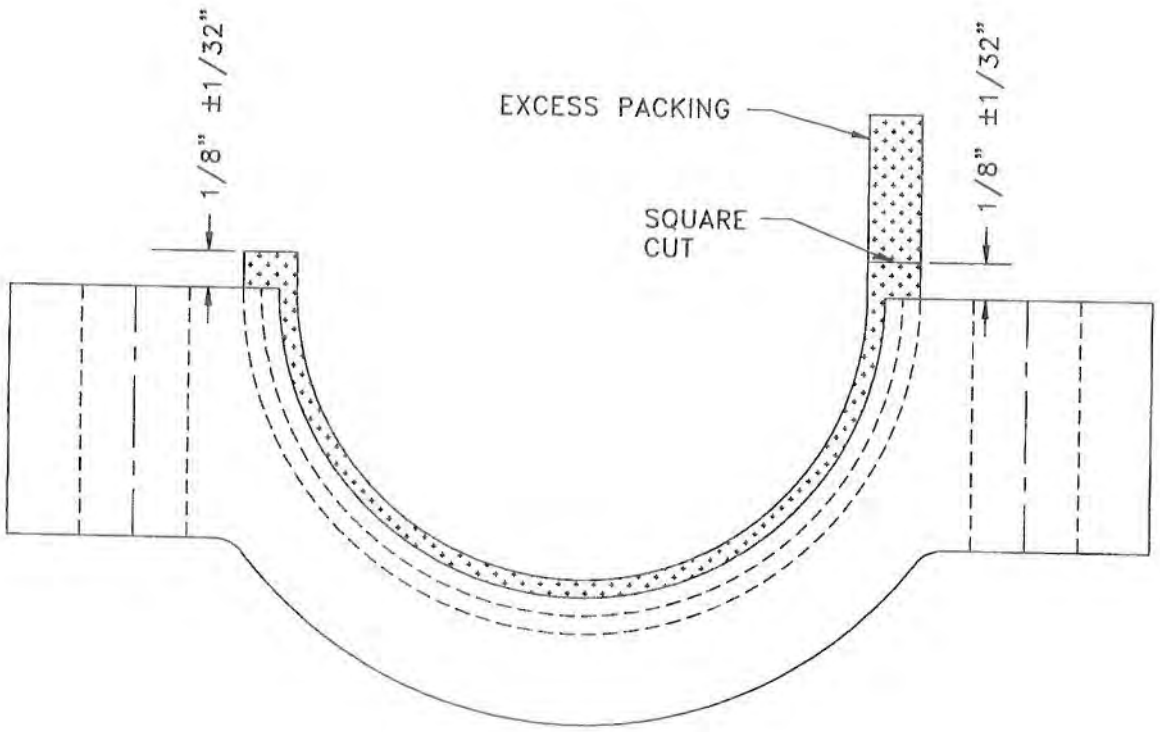
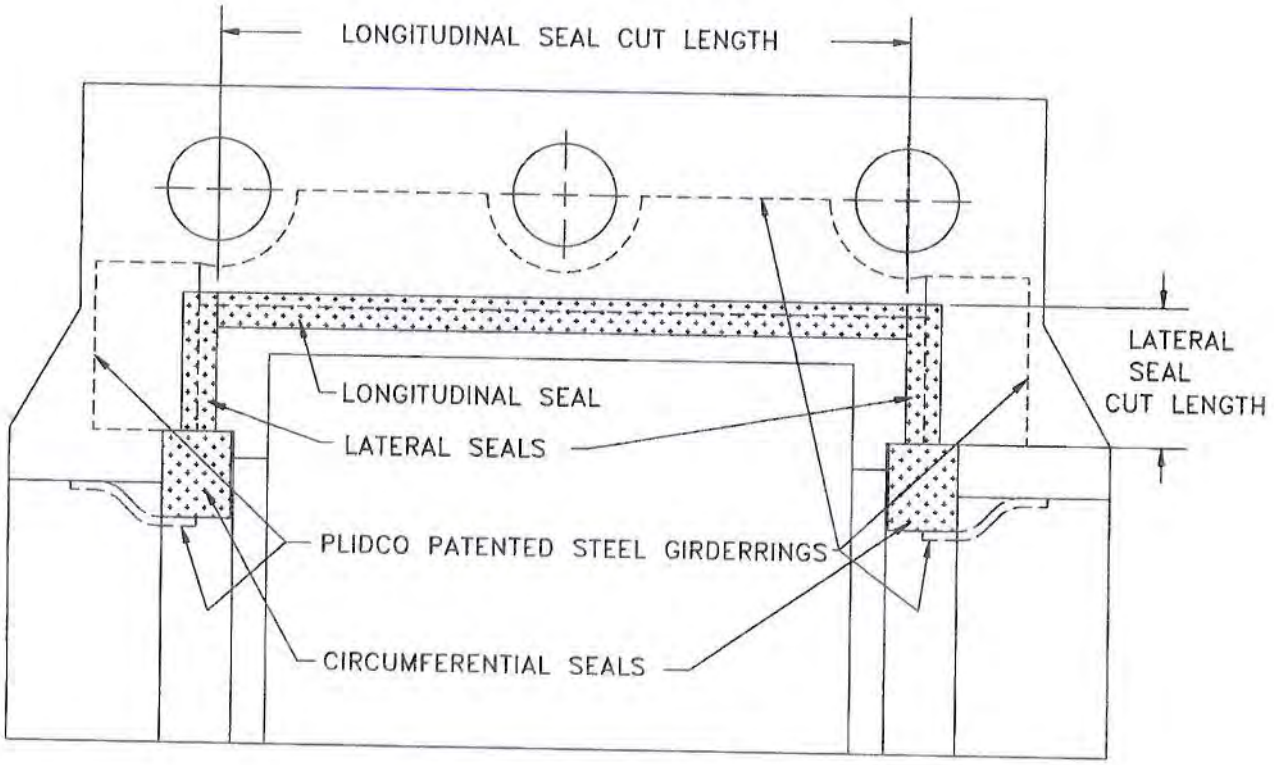


FIG. D

CLOSED STYLE SIDE SEAL GROOVES WITH LATERAL GROOVES



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PLIDCO® SPLIT+SLEEVE INSTALLATION INSTRUCTIONS

!! WARNING!!

IMPROPER SELECTION OR USE OF THIS PRODUCT CAN RESULT IN EXPLOSION, FIRE, DEATH, PERSONAL INJURY, PROPERTY DAMAGE AND/OR HARM TO THE ENVIRONMENT.

Do not use or select a Plidco Split+Sleeve until all aspects of the application are thoroughly analyzed Do not use the Plidco Split+Sleeve until you read and understand these installation instructions. I you have any questions, or encounter any difficulties using this product, please contact:

PLIDCO "DEPARTMENT 100" at 440-871-5700
toll free U.S. & Canada at 800-848-3333

READ CAREFULLY

The person in charge of the repair must be familiar with these instructions and communicate them tc all personnel involved in the repair crew.

Safety Check List

Pipeline repairs can be made with the pipeline in operation or shutdown.

- ❑ 1. Read and follow these instructions carefully. Follow your company's safety policy and applicable codes and standards. If the Plidco Split+Sleeve is to be installed underwater, be sure to read the *Underwater Installation* section.
- ❑ 2. The Plidco Split+Sleeve should never be used to couple pipe unless sufficient end restraint is provided such as with a Plidco Clamp+Ring. The Plidco Split+Sleeve has no end restraint rating in its unwelded condition, and if so utilized could result in EXPLOSION, FIRE, DEATH, PERSONAL INJURY, PROPERTY DAMAGE, AND/OR HARM TO THE ENVIRONMENT.
- ❑ 3. Observe the working pressure and temperature on the label of the Plidco Split+Sleeve. Do not exceed the maximum working pressure or temperature as indicated on the unit.
- ❑ 4. The Plidco Split+Sleeve may be operated at the full design pressure in its bolted (non-welded) state.
- ❑ 5. When repairing an active leak, extreme care must be taken to guard personnel. Severe injury or death could result.

☐ 6. If the pipeline has been shut down, repressuring should be done with extreme caution. Repressuring should be accomplished slowly and steadily without surges that could vibrate the pipeline and fitting. Industry codes and standards are a good source of information on this subject. Except for testing purposes, do not exceed the design pressure of the Plidco Split+Sleeve. Personnel should not be allowed near the repair until the seal has been proven.

Pipe Preparation

1. Remove all coatings, rust and scale from the pipe surface where the circumferential seals of the Plidco Split+Sleeve will contact the pipe.
2. The seal can tolerate minor surface irregularities up to ± 1/32 inch (0.8 mm).
3. Ensure the pipe is round where the circumferential seals will contact the pipe. Repositioning the Plidco Split+Sleeve or the use of a different length Plidco Split+Sleeve may be required.

Installation

Careless handling can damage the seals and GirderRings. Lifting devices such as chains, cables or lift truck forks should not be allowed to contact the seals or GirderRings. Contact can result in the seals being pulled from their grooves. (See Figure 1)

1. Coat all exposed surfaces of the seals with a lubricant. The chart below lists the lubricants that are recommended for the various seals. The customer must determine if the lubricant is compatible with the product in the pipeline.

Petroleum based lubricants	= A
Silicone based lubricants	= B
Glycerin based lubricants	= C
Super Lube® Grease (1)	= D

		Temperature (2)
Buna-N	A, B, C, D	225°F (107°C)
Viton	A, B, C, D	250°F (121°C)
Silicone	C, D	300°F (149°C)
Neoprene	B, C, D	250°F (121°C)
Aflas	A, B, C, D	225°F (107°C)
Hycar	A, B, C, D	180°F (82°C)
Teflon	A, B, C, D	500°F (260°C)
Kevlar	A, B, C, D	750°F (399°C)

(1) Super Lube® Grease is a product of Synco Chemical Corporation. (www.super-lube.com)
(2) Temperature limit is for the seal material only and does not imply the pressure rating is necessarily applicable at this limit.

2. Clean and lubricate all studbolts and nuts, and prove free and easy nut running prior to the installation.
3. Assemble the Plidco Split+Sleeve around the pipe making sure the yellow painted ends are matched and that the fitting is centered over the leak and/or damaged area as much as possible. Sometimes it is helpful to loosely assemble the Plidco Split+Sleeve to one side of the leak, than reposition it centered over the leak.

4. All studbolts and nuts should be uniformly torqued as indicated by the *Plidco Torque Cha* located on the back cover. The best results are obtained by maintaining an equal gap a around, between side bars, while tightening the studbolts. Ensure a minimum of 1/4 inch (6. mm) of studbolt extends beyond the nut.
5. To complete assembly, ALL studbolts should be rechecked at the recommended torque. Kee in mind; an increase in torque on one studbolt can cause a decrease in torque on neighborin studbolts.
6. The side bars are gapped approximately 1/8 inch (3.2 mm) when the Plidco Split+Sleeve is full tighten.

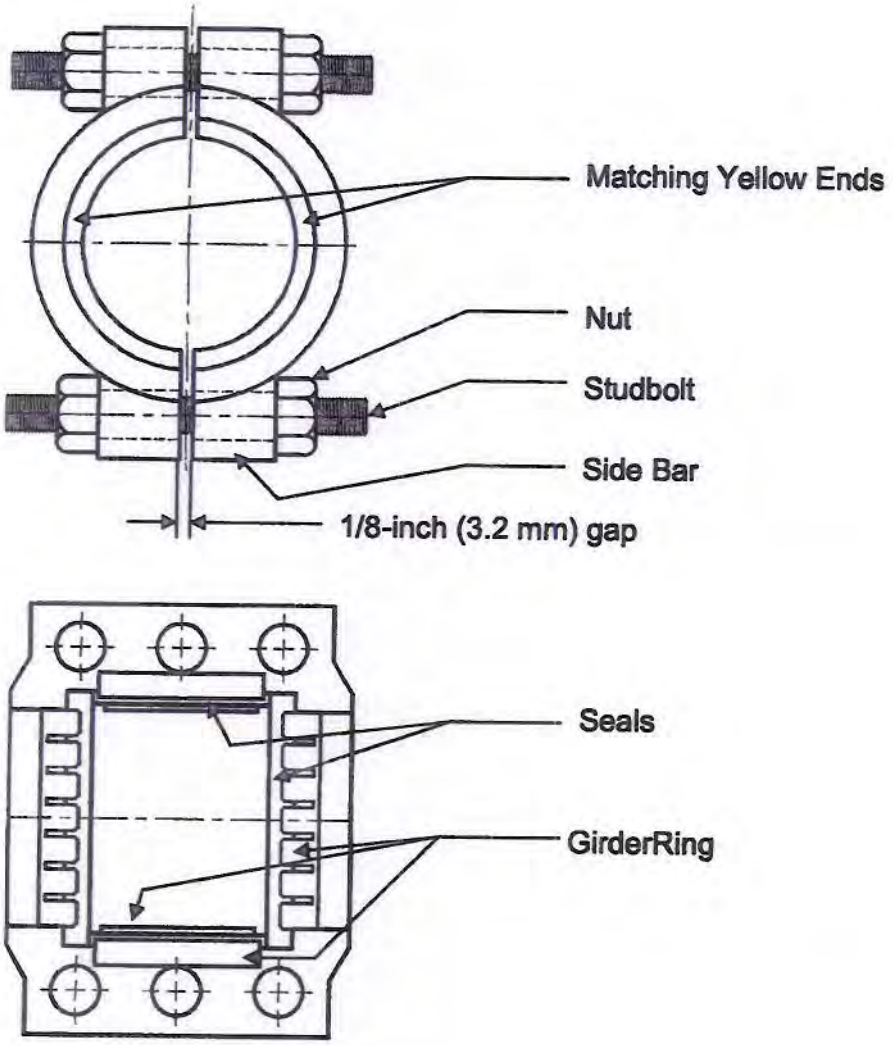

Figure 1

Repressuring and Field Testing

If the pipeline has been shut down, repressuring should be done with extreme caution. Repressuring should be accomplished slowly and steadily without surges that could vibrate the pipeline and fitting. Industry codes and standards are a good source of information on this subject. Except for testing purposes, do not exceed the design pressure of the Plidco Split+Sleeve. The Plidco Split+Sleeve can be field tested up to 1½ times its design pressure. Personnel should not be allowed near the repair until the seal has been proven.

Field Welding Instructions

Welding is not a requirement for the pressure sealing ability of the Plidco Split+Sleeve. The issue of welding is dependent on your company's requirements, applicable codes, and if longitudinal loads need to be carried by the Plidco Split+Sleeve.

Failure to follow field welding instructions could result in explosion, fire, death, personal injury, property damage and/or harm to the environment.

PIPELINE SHOULD BE FULL AND UNDER FLOW

Use weld material with equal or greater tensile strength than the pipe. Carefully control the size and shape of the circumferential fillet welds. The size of the fillet weld should be at least 1.4 times the wall thickness of the pipe. This assumes a 1.0 joint efficiency. You may need to select a different joint efficiency based on your level of inspection. Strive for a concave faced fillet weld, with streamlined blending into both members; avoid notches and undercuts. The smoother and more streamlined the weld, the greater the resistance to fatigue failure. The worst possible shape would be a heavy reinforced convex weld with an undercut. Improper weld shape can lead to rapid fatigue failure, which can cause leakage, rupture or an explosion with attendant serious consequences.

Welders and weld procedures should be qualified in accordance with API Standard 1104, *Welding of Pipelines and Related Facilities*, Appendix B, *In-Service Welding*. We strongly recommend the use of a low hydrogen welding process such as GMAW or SMAW using low hydrogen electrodes (E-XX18) because of their high resistance to moisture pick-up and hydrogen cracking. These are also the preferred welding process for seal welding the studbolts and nuts. SMAW electrodes must be absolutely dry.

It is very important that the field welding procedure closely follow the essential variables of the qualified procedure so that the quality of the field weld is represented by the mechanical tests performed for the procedure qualification.

We do not recommend the use of thermal blankets for pre-heating. Thermal blankets can generate hot spots and reduce the ability of the Plidco Split+Sleeve to dissipate welding heat in the vicinity of the seals. We recommend a small torch, such as a cutting torch, being careful not to aim the flame directly into the gap between the Plidco Split+Sleeve and the pipe towards the seals. The flame from a preheat torch is helpful in burning off oils and other contaminates. Do not use a large torch, commonly called a rosebud, because of the difficulty controlling the size of the area being preheated.

Monitor the heat generated by welding or preheating, particularly near the area of the seals, by using temperature crayons or probe thermometers. If the heat generated approaches the temperature limit of the seal material, which is indicated on the label, welding should be discontinued or sequenced to another part of the fitting so that the affected area has a chance to cool.

Seal welding the grade B-7 studbolts of the Plidco Split+Sleeve is the most difficult phase of fiel welding. They are made of AISI 4140 steel with a high carbon equivalence. By using a low hydroge welding process with preheat, the problem of hydrogen cracking and pinholes can be reduced. Th preheat will dry out any moisture, oil dampness or thread lubricant that may be present in the wel area. If the studbolt lengths need to be cut back, allow at least 1/4 inch (6.4 mm) of studbolt beyon the nut for the fillet weld. Preheat the sutdbolt and nut and then weld the nut to the studbolt. Chec the preheat and weld the nut to the sidebar.

Welding Sequence

1. Caution should be observed so that welding does not overheat the seals. Sequence the weldin so that the heat is not concentrated in one area. It will be necessary to re-torque the studbolt and nuts periodically during field welding because weld contraction causes them to loosen.
2. Fillet weld ends to pipe. (See Figure 2)
3. Seal Weld side openings.
4. Re-torque studbolts and nuts.
5. Seal weld nuts to studbolts.
6. Seal weld nuts to side bars.
7. Seal weld vent plugs, if applicable.

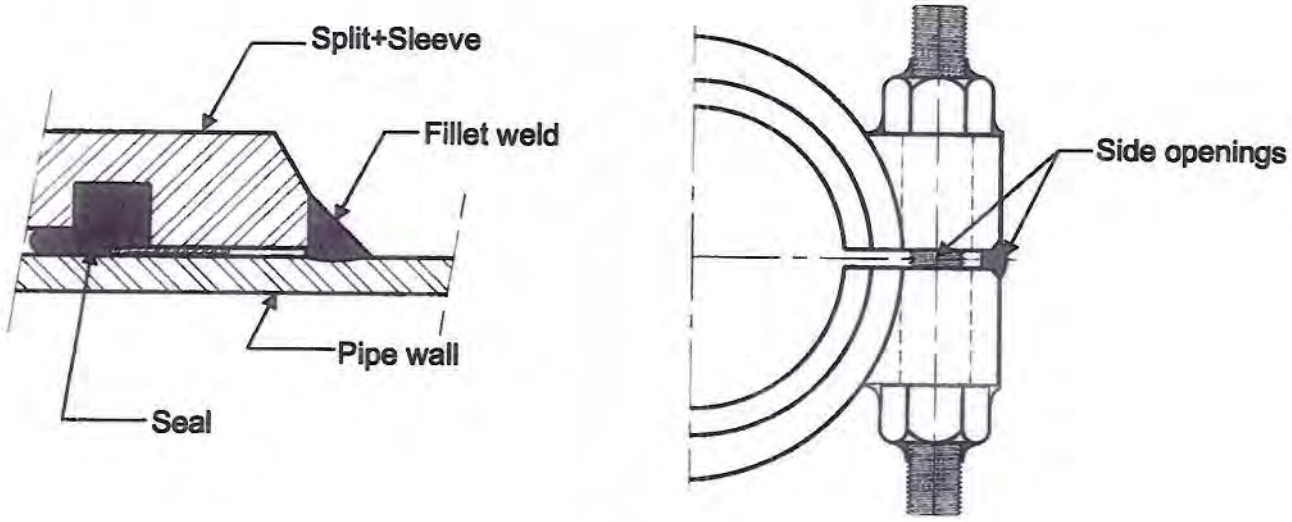

Figure 2