

## Business Case – Capital Expenditure

# Emergency Response

Business Case Number 239

## 1 Project Approvals

TABLE 1: BUSINESS CASE – PROJECT APPROVALS

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## 2 Project Overview

TABLE 2: BUSINESS CASE – PROJECT OVERVIEW

<b>Description of Issue/Project</b>	<p>The VTS is required to maintain emergency response and recovery equipment and material in order to deliver timely management and recovery from pipeline events.</p> <p>The inability to efficiently and effectively respond and repair pipeline damages could result in prolonged loss of supply to customers and greater risks of Health &amp; Safety and Environmental impacts from emergency scenarios to workforce and neighboring communities.</p>
<b>Options Considered</b>	<p>The following options have been considered:</p> <ol style="list-style-type: none"> <li>Option 1: Do Nothing Option</li> <li>Option 2: Third Party Emergency Response</li> <li>Option 3: Purchase Emergency Response Equipment (Proposed Solution)</li> </ol>
<b>Estimated Cost</b>	\$1,760,714 (escalated)
<b>Consistency with the National Gas Rules (NGR)</b>	<p>The acquisition of equipment for emergency response complies with the new capital expenditure criteria in Rule 79 of the NGR because:</p> <ul style="list-style-type: none"> <li>it is necessary to maintain and improve the safety of services and maintain the integrity of services (Rules 79(2)(c)(i) and (ii)); and</li> <li>it is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services (Rule 79(1)(a)).</li> </ul>
<b>Stakeholder Engagement</b>	<p>The primary stakeholders affected by this project are:</p> <ul style="list-style-type: none"> <li>Energy Safe Victoria</li> <li>Australian Energy Market Operator</li> </ul>

## 3 Background

VTS Australia (Operations) Pty Ltd (VTS) under APA Group is a declared operator of a Declared Essential Service under the Terrorism (Community Protection) Act 2003. Under the Act, APA must prepare a risk management plan meeting the requirements set out in the Act, including emergency response and recovery. In addition, the Pipeline License requires APA to maintain compliance with Australian Standard AS2885.3. This standard stipulates that the Pipeline Operator must maintain suitable emergency response equipment.

This business case is for the emergency response and recovery equipment, fittings and tools. The subsequent sections describe the background of various equipment, fittings and tools considered in this business case.

### 3.1 Emergency Repair Fittings and Equipment

The emergency repair fittings and equipment for the VTS is housed in the Dandenong store. Some of this equipment was purchased from the 1970s and is not adequate for providing repairs for several pipelines within VTS. This is due to following factors:

1. Lack of fitting or equipment traceability and documentation.
2. High level difficulty of servicing the fittings and equipment due to age and lack of documentation.
3. Fittings and equipment with known Maximum Working Pressure (MWP) are not suitable for pipelines that have Maximum Allowable Operating Pressures (MAOP) up to 10,200 kPa (CL600 pressure) within VTS.

The emergency repair fittings and equipment as part of this business case scope include the following:

1. Hot Tap Fittings (including Stoppie Fittings) for Hot Tap pipeline repairs.
2. Bolt-On Repair Clamps for temporary pipeline repairs.
3. Weldable Repair Fittings (e.g. Weld + Cap Fittings for pin-hole leak repairs).

#### Hot Tap Fittings

From a previous project where TD Williamson serviced the Hot Tap fittings housed in the store, they have recommended that the fittings in Table A, *Appendix A* should be replaced due to the lack of fittings traceability and documentation and high level difficulty of servicing. In total, 20 fittings require to be replaced.

Additionally, an analysis was conducted to compare the Hot Tap fittings Maximum Working Pressure (MWP) and the VTS pipeline lowest and highest MAOP based on pipeline diameter to determine whether these fittings remain suitable for Hot Tap repairs. Table B, *Appendix A* shows the fittings that are not suitable for pipelines with the highest MAOP for their given diameter size. The fittings tabulated can be used for pipelines with lower MAOPs.

#### Bolt-On Repair Clamps

The MWP of the Plidco Split and Sleeve Bolt-On Repair Clamps were compared with VTS pipelines with the lowest and highest MAOPs based on pipeline diameter to determine whether these clamps remain suitable for providing temporary pipeline repairs. Table C, *Appendix A* shows the clamps not suitable for VTS pipelines that have the highest MAOP. The new DN400 Victorian Northern Interconnect pipeline is licensed to operate up to 15,300 kPa. The clamps can be used for pipelines with lower MAOPs.

#### Weldable Repair Fittings

Table D, *Appendix A* display the weldable repair fittings that do not have material certificates or pressure ratings. These fittings are therefore not recommended to be used for emergency response and recovery operations.

In summary, the majority of emergency repair fittings and equipment shown in Appendix A are not recommended to be used for emergency response and recovery operations. This is due to a combination of factors - the documentation for some of this equipment and fittings was misplaced, age and obsolescence, and pipelines with higher MAOPs have been built in VTS.

The ability for APA to response efficiently and effectively to repair pipeline damages during an emergency will be greatly degraded due to the long lead times on these items. This will result in prolonged loss of supply and greater risks of Health & Safety and Environmental impact from emergency scenarios.

### 3.2 Emergency Fuel Storage

The Information Technology (IT) infrastructure and control room facilities located at the Dandenong premises have critical IT equipment that are essential for operating VTS assets. The control room relies heavily on the IT infrastructure to deliver situational awareness to manage an emergency and to supply gas reliably. Currently, one

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back-up diesel generator is available which automatically supplies power to these facilities up to its fuel tank capacity if there are power interruptions in the Victorian power grid.

The scenario envisaged is a widespread, prolonged loss of electricity would prevent service stations delivering fuel. This prolonged scenario would exceed the fuel capacity of the backup generator and cause a loss of electricity to the control room and loss of control.

Additionally, if securing a reliable supply of diesel within Victoria is difficult due to a fuel shortage, VTS would need additional emergency fuel storage to supply diesel to Technicians' vehicles used for emergency response purposes or general operation.

### 3.3 Emergency Tools and Equipment

The emergency tools and equipment covered in this business case are shown below. The justification of requiring this equipment is explained in the subsequent sections.

1. Breathing Apparatus & Confined Space equipment
2. Spark-proof tools
3. Emergency Caravan

#### Breathing Apparatus & Confined Space Equipment

Self-contained breathing apparatus (SCBA) equipment is used for working in confined spaces if natural gas is present and emergency evacuations.

The duration of the air cylinder attached to SCBA equipment lasts up to 30 minutes. If the work activity extends beyond this timeframe, field personnel need to stop work and withdraw from the work environment safely to prevent asphyxiation. This short duration of the air cylinders can delay the work schedule which can impact on isolating gas leaks.

There is one confined space entry kit housed in the workshop and is shared between Field Services teams across Victoria. If this kit is in use, there could be an emergency involving a confined space environment and there would be no kits available. This could impact on the response time to assess and contain the hazard within the confined space which can result to prolonged loss of supply and increased risk of casualties and fatalities and damage of the environment.

#### Spark-proof Tools

The Field Services team have spark-proof tools to prevent the creation of sparks when used in a work environment that contains combustible materials. The suite of tools available is developing and replacements are necessary.

#### Emergency Caravan

Within Victoria, APA has one emergency caravan available and stored in Dandenong. The caravan provides amenities to field based personnel during normal work and emergency response operations. The benefits of this equipment are for field personnel to reduce fatigue and provide access to basic amenities. However, the caravan is obsolete as it is too heavy to be towed by a vehicle other than a truck, has outdated facilities that are no longer suitable is no longer road worthy. Since the caravan cannot be used for its intended purpose the costs to bring the vehicle up to an acceptable standard for road worthy is not an efficient use of capital.

### 3.3 Emergency Vent Stacks

The vent stacks housed in the Dandenong workshop are suitable for pipelines with MAOPs up to 5,100 kPa (CL300 pressure) and 10,200 kPa. These vent stacks do not have pressure rating information on the body and are not suitable for using on pipelines that have MAOPs up to 10,200 kPa. Additionally, some of these vent stacks do not have adaptor fittings to be fitted as they will be installed on special enclosures (e.g. Huber Yale and Unibolt

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closures) in main line valve (MLV) sites for usage. This can drastically affect pipeline blowdown operations within the VTS system especially during emergency response.

With the Victoria Northern Interconnect Expansion (VNIE) pipeline construction finishing in the near future, it will be the first pipeline that has a MAOP of 15,300 kPa (CL900 pressure) within VTS. This pipeline requires vent stacks suited for this pressure rating for pipeline blowdowns, refer to BC240 for further information.

## 4 Risk Assessment

The risks associated with poor emergency response and recovery is the inability to mitigate consequence escalation or reinstate normal operations in an efficient manner. Whilst the VTS has gas supplied from multiple sources, the capacity of the network is severely constrained during an emergency scenario. This would potentially lead to a loss of supply of gas to major customers and consumers.

In addition, the Field Services team requires the most appropriate equipment to perform emergency work safely. Attempting to perform high risk work without appropriate equipment could lead to severe Health and Safety consequences to VTS personnel or the neighboring public and adversely affect the environment.

Table 1 summarises the untreated risks rating associated with VTS maintaining their current equipment, tools and fittings for emergency response and recovery purposes.

**TABLE 1: RISK RATING**

Risk Area	Risk Rating
Health and Safety	<b>Moderate</b>
Environment	<b>Low</b>
Operational	<b>Moderate</b>
Customers	<b>Moderate</b>
Reputation	<b>Moderate</b>
Compliance	<b>Moderate</b>
Financial	<b>Moderate</b>
<b>Final Untreated Risk Rating</b>	<b>Moderate</b>

## 5 Options Considered

### 5.1 Option 1 – Do Nothing

This option involves VTS not proceeding to acquire the emergency response and recovery equipment, fittings and tools mentioned in Section 3, *Background*.

#### 5.1.1 Cost/Benefit Analysis

This option is strongly not recommended as this can result in a major inadequacy in emergency response and recovery capability for VTS as well as other stakeholders that contract VTS for their operational services due to:

- Having insufficient tools and equipment for emergency response and recovery activities especially working in hazardous areas.
- The repair equipment and fittings are not fit for purpose and not suitable for emergency repair and recovery operations.

- Inadequate facilities for field based personnel who may work for extended duration in remote areas.
- Limited emergency fuel storage (diesel) for sustaining crucial IT infrastructure for normal and emergency response operations, if there is a fuel shortage.

## 5.2 Option 2 – Third Party Emergency Response

This solution involves VTS seeking assistance from third parties (such as other pipeline operators, service and rental equipment companies etc.) to use their equipment and tools for emergency response and recovery.

This option also includes the Services and Goods agreement between APA Group and service companies such as TD Williamson, Furmanite and Tremco. The agreement ensures that these companies supply emergency response and recovery equipment and fittings such as Hot Tap Fittings and Bolt-On Repair Clamps to be deployed and sent to site with minimal costs and time expended for projects and emergency response.

### 5.2.1 Cost/Benefit Analysis

The benefit of this option is that VTS can access the necessary equipment, fittings, tools and facilities for emergency response and recovery purposes.

However, there are shortfalls with this option as this relies on the Third Party emergency equipment inventory. The shortfalls include:

- The equipment, fittings, tools and facilities are not available at the time of need.
- Long lead times of the equipment, tools and fittings especially the Hot Tap Fittings and Bolt-On Repair Clamps can lead to delayed emergency response and recovery. (The maximum lead time for some items is 42 days based on the Services and Goods agreement)
- The equipment, fittings and tools may not be suitable for use (e.g. not been serviced, no certificates, inadequate pressure ratings etc.)
- VTS personnel may not be familiar with using the equipment, fittings and tools and there is a risk of incorrect use during emergency response and recovery.
- Liability of damaging the equipment, fittings and tools belonging to the Third Party.

It is not recommended to rely on equipment and tools owned by Third Parties as the shortfalls above can compound risks which can lead to unnecessary delays, costs and risks during emergency response. This can increase the risk of prolonged loss of supply, casualties and fatalities of personnel and damage to the environment.

That said, there is merit to engage other Victorian pipeline operators to develop shared access to equipment and fittings, mobile field accommodation as well as emergency diesel storage; under a mutual support agreement. This possibility will take time to explore and mature.

## 5.3 Option 3 – Purchase Emergency Response Equipment

APA has had a long standing policy of maintained emergency response equipment necessary for foreseeable pipeline incidents. This equipment requires replacement and augmentation over time. By proceeding with this option, APA has confidence that management and personnel have the adequate equipment, tools and fittings to perform emergency response and recovery operations in a timely and safe manner.

### 5.3.1 Cost/Benefit Analysis

One benefit of this option is that VTS improves its capability in emergency response and recovery as there is minimal reliance on Third Party equipment, tools and fittings for these operations. As a result, there is less potential

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for delays in rectifying the emergency due to equipment, fittings and tools being always available and fit for purpose. Additionally, APA will not hold a third party liability if damages occur to equipment and fittings supplied by a third party.

Another benefit is that equipment, tools and fittings newly purchased have documents provided which ensures that they are in compliance with the current design standards and safe to use for emergency response and recovery.

There are maintenance costs involved with servicing, overhauling and storing these items to ensure that they are fit for purpose for emergencies in the long term.

### 5.4 Summary of Cost/Benefit Analysis

Table 2 below summaries the benefits of the three options explained in the previous sections as well as the associated cost estimates for each option.

**TABLE 2: SUMMARY OF COST/BENEFIT ANALYSIS**

Option	Benefits (Risk Reduction)	Costs
Option 1	<ul style="list-style-type: none"> <li>VTs is not required to purchase emergency equipment, tools and fittings.</li> </ul>	All the risks detailed in section 4
Option 2	<ul style="list-style-type: none"> <li>VTs offsets CAPEX expenditure by leasing emergency equipment, fittings and tools from Third Parties.</li> <li>VTs does not require to store and maintain Third Party emergency equipment, fittings and tools.</li> </ul>	<p>Less operational control and potential delays to emergency response.</p> <p>Depending on the lease and replacement costs of equipment based from third parties.</p> <p>Long term cost greater than initial capital cost</p>
Option 3	<ul style="list-style-type: none"> <li>VTs is self-reliant and has improved capability in emergency response.</li> <li>Emergency equipment, fittings and tools is always available</li> <li>VTs staff is familiar with using their own emergency equipment, fittings and tools.</li> <li>VTs owned emergency equipment is suited for VTs pipelines</li> </ul>	<p>\$1.7 million comprising the following:</p> <ul style="list-style-type: none"> <li>Emergency fuel storage = \$ 140k</li> <li>Breathing Apparatus and Confined Space Entry (CSE) equipment = \$ 20k</li> <li>Spark Proof Tools = \$10k</li> <li>Emergency Caravan = \$120k</li> </ul> <p>Estimate of storage and maintenance cost (OPEX) of these emergency items would be a minimum of 5% compared to total CAPEX.</p>

### 5.5 Proposed Solution

#### 5.5.1 What is the Proposed Solution?

Option 3 is the proposed solution to address the inadequacy of emergency response and recovery equipment, fittings and tools and covers the acquisition of these as mentioned in the subsequent sections.

#### Emergency Repair Fittings and Equipment

To address the inadequacy of Hot Tap Fittings and Bolt-On Repair Clamps suitable for pipelines that have MAOP up at full CL600 pressure. The proposed solution is to purchase new fittings and equipment that have Maximum Working Pressure compatible with these pipelines.

#### Emergency Fuel Storage

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The proposed solution is to acquire a diesel fuel storage tank that can supply fuel to allow the back-up diesel generator to operate five days to supply power to the IT and Central Control Room in the Dandenong operations centre. The diesel fuel storage tank will also need to supply one full tank for vehicles travelling to site for emergency response.

### Emergency Tools and Equipment

#### *Breathing Apparatus and Confined Space Entry Equipment*

To address the shortage of confined space entry kits especially for emergency response, the solution is to purchase two additional confined space entry kits. One of the kits supplements the existing kit for the Victorian field services teams to use and the other solely for emergency response.

To address the short working duration of the current SCBA equipment, the proposed solution is to acquire a portable cart that house multiple air cylinders that can supply air up to 2 to 3 hours. The air cart requires clamps to hold onto the cylinders and hoses to connect to the SCBA, the field personnel wear.

#### *Spark Proof Tools*

As spark proof tools can be ordered from local suppliers and have short lead times, the solution to address the shortage of these tools within the Field Services teams is to provide them a lump sum allowance every two years for Area managers to purchase new tools or replace damaged tools, as required.

#### *Fully Equipped Caravan*

The proposed solution to provide better amenities and facilities for Field based personnel is to replace the current emergency caravan with a new caravan that is towable by four-wheel drive vehicles. The new caravan is to have an eating and work area, a diesel generator as a power source, and is able to house up to 5 people.

### Emergency Vent Stacks

As the vent stacks may not be adequate for pipelines that have MAOPs at full CL600 and CL900 pressures, the solution is to conduct preliminary studies on plume dispersion and depressurisation rate for the range of blowdown scenarios in VTS as well as detailed cost estimation, design and fabrication of any new vent stacks required. The fabrication of adaptor fittings (for fitting the vent stacks on special enclosures) and the acquisition of lifting equipment and storage baskets for this equipment are included in this solution.

#### 5.5.2 Why are we proposing this solution?

By selecting Option 3 as the proposed solution, VTS improves its capability to respond to emergencies within VTS as well as having the equipment to perform repair and recovery works on VTS pipelines that have MAOP equal and greater than CL600 pressures (10,200 kPa and above). VTS will be in a satisfactory position for rectifying emergencies.

Additionally, unnecessary delays and complications are minimised during emergency response, resulting in a reduction in risk consequence as VTS maintains the ability to rectify emergencies in a self-reliant manner rather than relying on third parties to provide equipment which may not be available or suitable as detailed in Option 2.

#### 5.5.3 Consistency with the National Gas Rules

##### Rule 79(1)

The proposed solution is consistent with Rule 79(1) of the National Gas Rules and APA considers the expenditure to be:

- **Prudent** – The expenditure is necessary to maintain and improve the readiness in emergency response and recovery operations within VTS.



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- **Efficient** – By acquiring the required emergency response equipment, the long term costs will be minimised compared to utilising a third party.
- **Consistent with accepted good industry practice** – Addressing the risks associated with having inadequate equipment for emergency response in terms of quantity and suitability for assets within VTS is considered as good industry practice. The Australian Standard AS2885.3 Section 11.2, *Emergency Response Plan (ERP)* the pipeline operator requires “adequate equipment, pipe and fittings fit for the intended purpose and readily available at all times, complete with traceable material test certificates”.
- **Achieves the lowest sustainable cost of delivering pipeline services** – The acquisition of the required emergency response equipment will ensure that the risks of emergency situations is reduced to as low as reasonably practical and maintaining reliability and security of supply to our customers and ensuring safety of people and the environment.

### 5.5.4 Forecast Cost Breakdown

Below is a cost breakdown for the emergency response and recovery equipment, fittings and tools acquired in accordance with the proposed solution.

**TABLE 3: FORECAST COST ESTIMATE (ESCALATED)**

Cost Allocations	Total (\$)
Breathing Apparatus	\$20,149
Response Equipment	\$1,469,227
Spark Proof Tools	\$10,323
Caravan	\$120,243
Fuel Storage	\$140,773
<b>Total</b>	<b>\$1,760,714</b>

### Emergency Repair Fittings and Equipment

Table 3 above is a forecast cost estimate for acquiring Hot Tap Fittings and Bolt-On Repair Clamps. The unit costs for these items are based on quotes provided by Tremco and TD Williamson. The quantity of these equipment is based on the quantity of current fittings and equipment not fit for purpose as well as new equipment required for pipelines that have MAOP up to CL600 pressures. The internal labour rates are based on approximate hourly rates of various occupational groups and freighting costs are based on the approximately hourly rate for the freight truck hire and the journey time.

### Emergency Fuel Storage

The cost estimate for acquiring the diesel storage tank, diesel fuel and installation in the VTS Dandenong premises. The unit cost of the diesel storage tank and associated accessories is based on the quote AUSTANK has provided.

The assumptions above for the cost estimates above and their justifications are detailed below:

1. The diesel storage tank is intended to be installed in the Dandenong premises only as the emergency diesel generator supplies back up power to VTS critical infrastructure such as the control room.
2. The diesel storage tank is assumed to be above ground to simplify the construction and cost estimation.



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3. The diesel storage tank is to supply 1 full tank of diesel fuel for APA's field technician's vehicles for emergency response purposes and supply fuel to the back-up diesel generator for 5 working days to supply back-up power if there is a shortage of diesel in Victoria.

### Emergency Tools and Equipment

#### *Breathing Apparatus and Confined Space Entry Equipment*

The cost estimate for acquiring the two confined space entry kits and the air cylinder cart. The unit cost of the confined space entry kits are based on the quote that a reliable vendor has provided. The unit cost of the air cylinder cart and the additional air cylinders are based on a cost estimate provided by our preferred supplier.

The assumptions for the cost estimates above and their justifications are detailed below:

1. Two confined space entry kits was assumed to be adequate as one kit will supplement the existing kit for the Victorian Field Services teams to use and the other solely for emergency response.
2. One air cylinder cart is deemed sufficient as the number of sites within confined spaces is lower compared to above ground sites.

#### *Fully Equipped Caravan*

The cost estimate of purchasing the new caravan complete with necessary fit out to be used for emergencies. The unit cost of the caravan is based on quote supplied by Work Caravans.

### Emergency Vent Stacks

The cost estimate for conducting preliminary studies such as plume dispersion and depressurisation rate for venting CL600 and CL900 pipelines as well as design, fabrication and commissioning of new vent stacks. The cost estimate also includes lifting and storage gear. The fabrication costs of the vent stacks are based from contractor cost estimates.

## Appendix A – Emergency Repair Fittings and Equipment

Fitting Description	Manufacturer	Fitting Part Number	Quantity
Hot Tap Split Tee 18" x 12" Branch	TD Williamson	06-1109-1812	2
Hot Tap Split Tee 30" x 10" Branch	TD Williamson	Unknown	2
Hot Tap Split Tee 16" x 12" Branch (Note 1)	TD Williamson	06-0954-0012	2
Hot Tap Split Tee 30" x 18" Branch	TD Williamson	Unknown	2
Hot Tap Split Tee 18" x 8" Branch	TD Williamson	Unknown	1
Hot Tap Split Tee 12" x 8"	TD Williamson	Unknown	2
Stopple Split Tee 18" CL150	TD Williamson	06-6472-1815	1
Stopple Split Tee 30"	TD Williamson	Unknown	2

**TABLE A:** Hot Tap Fittings deemed to be replaced as per TD Williamson recommendation from 2014-2015 servicing and inspection

Fitting Description	Manufacturer	Fitting Part Number	Quantity	Fitting Main Diameter (mm)	Fitting MWP (kPa)	Pipeline Lowest MAOP (kPa)	Pipeline Highest MAOP (kPa)
8" Stopple Fitting	TD Williamson	26-0741-0860	3	200	7385	2760	10200
8" Stopple Fitting	TD Williamson	06-3839-0008	1	200	9928	2760	10200
Hot Tap Split Tee 18"x8" Branch	TD Williamson	36-1488-1808	1	450	7412	2760	10200
18" Stopple Fitting	TD Williamson	06-8807-1860	1	450	9928	2760	10200
18" Stopple Fitting	TD Williamson	36-1239-1860	1	450	7385	2760	10200
Hot Tap Split Tee 20"x8" Branch	TD Williamson	06-6058-2008	2	500	9928	2760	10200
20" Stopple Fitting	TD Williamson	06-6484-0020	2	500	9928	2760	10200
20" Stopple Fitting	TD Williamson	06-3839-0020	2	500	9928	2760	10200
30" Stopple Fitting	TD Williamson	26-1129-3060	1	750	2758	2760	7070

**Table B:** Hot Tap Fittings that are not suitable for providing Hot Tap Repairs for VTS pipelines that have the highest MAOP based on pipeline diameter

Equipment Description	Manufacturer	Quantity	Clamp Nominal Diameter (mm)	Clamp MWP (kPa)	Pipeline Lowest MAOP (kPa)	Pipeline Highest MAOP (kPa)
Split + Sleeve	Plidco	4	100	6895	2,760	9,890
Split + Sleeve	Plidco	4	150	6895	2,760	9,890
Split + Sleeve	Plidco	3	300	6895	2,760	8,800
Split + Sleeve	Plidco	2	350	6895	7,390	10,200
Split + Sleeve	Plidco	1	450	6895	2,760	10,200
Split + Sleeve	Plidco	3	500	6895	2,760	10,200
Split + Sleeve	Plidco	3	750	6895	2,760	7,070

**Table C:** Bolt-On Repair Clamps not suitable for providing temporary repairs for VTS pipelines that have the highest MAOP based on pipeline diameter

Manufacturer	Fitting Description	Quantity
Plidco	4" Weld + Plate Fitting	2
Plidco	6" Weld + Plate Fitting	2
Plidco	8" Weld + Plate Fitting	2
Plidco	10" Weld + Plate Fitting	2
Plidco	12" Weld + Plate Fitting	2
Plidco	14" Weld + Plate Fitting	2
Plidco	16" Weld + Plate Fitting	2
Plidco	18" Weld + Plate Fitting	2
Plidco	20" Weld + Plate Fitting	2
Plidco	24" Weld + Plate Fitting	2
Plidco	30" Weld + Plate Fitting	2
TD Williamson	2" CL600 Thread-O-Ring Fitting	2

**Table D:** Other Weldable Repair Fittings not suitable for usage since they have no material certificates or pressure ratings.