

**MELFRED
BORZALL**

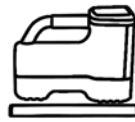
FROM THE MAKERS OF HDD'S TOUGHEST HOUSINGS, WE PRESENT:

TRANSMITTER HOUSING SELECTION GUIDE

*A Comprehensive Guide To Selection The Correct Transmitter For Your Jobsite Circumstances
Such As Rig Thrust, Transmitter Model, & Other Important Factors.*



TABLE OF CONTENTS



INTRODUCTION:

HOUSINGS & HDD LOCATING

To start things off, we'll first give you an overview of the concepts behind housing selection & how it impacts locating & operations

1

CONSIDERATIONS DURING SELECTION

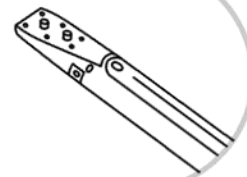
There are certainly good questions to ask yourself and we'll go over the vital ones in this section for you.



2

TRANSMITTER HOUSING TYPES

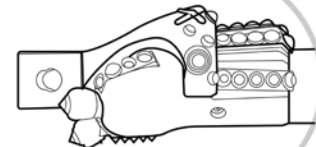
We'll discuss all types of housings here including thread-on and bolt-on types of housings for different applications.



3

COMPLETE DRILL HEAD SOLUTIONS

Here we'll discuss how housings fit into full drilling systems as solutions for specific job types.



This guide can help experienced & new drillers limit mistakes when selecting a transmitter housing and quickly become an invaluable crew member because you can drive profitability & decision-making.



TRANSMITTERS & HDD LOCATING

Horizontal Directional Drilling (HDD) processes have come a long way in the past 50 years, and choosing the right transmitter housing for your job and process is not the same today as it was in the early years. Don't worry; we aren't going to bore you with a history lesson, but knowing some key pieces of information about the evolution of locating and the tools involved will help you understand your current (or future) locating and housing options better.

In the early days of earth boring, there was no way to know where your bit was going to go, let alone if it was going to snag something else. In those early years, there also wasn't so much underground utility congestion since proper horizontal directional drilling had not yet been invented.

Today, by means of a radio signal, we can know where our drill head is underground without seeing it. The transmitter emits the signal, while a receiver captures and translates the signal into a location above ground. In order for that transmitter to work, it must be protected. There are different types of transmitters for different applications, but we'll refer you to this article about transmitter types if you are looking to dive deep into that. This article is primarily about "housing" or protectors of transmitters. There are some considerations that a driller must make in order to ensure his transmitter is working properly and well-protected. The following is a series of questions that, if answered, will help determine what type of transmitter housing is needed.



1

PART ONE

WHEN SELECTING A HOUSING,
**WHAT ARE THE
RIGHT QUESTIONS?**





WHAT ARE MY SITE & JOB CONDITIONS?

There are different types of locating, including wireline and gyro-based locating - but our focus for this article is solely on walk-over locating in HDD applications. Also, we won't dig into the various systems, but there is available another useful article that explains the differences between each locating system. Here are some vital questions you should be asking yourself before making any decisions on a housing:

- What is my job's ground type and terrain?
- What distance & depth will I be drilling for this job?
- Is there any known existing utility where I'm drilling?
- What is the maximum diameter I need the pilot hole to be?
- Do I need something versatile that can be used with several bits or transmitters, or do I need a specialized for this specific job?
- What sort of pullback is optimal for my ground and job conditions?

WHAT COMPATIBILITY CONSIDERATIONS SHOULD I MAKE?

Suppose you are purchasing a new full setup (housing, locating system, and tooling). In that case, it is much easier to ensure everything is compatible than replacing only one worn-out part of a full setup. If this is you, then you should be thinking about future-proofing your tooling purchases to the greatest extent possible. For example, suppose you are purchasing a 3-1/4" housing for a current setup that you know will stay regional in the same ground type. In that case, you will likely want to ask yourself if direct pullback will ever be a consideration or possibility in the future. If so, you'll want to look at purchasing a transmitter housing that comes already equipped with those features, even if you aren't using them right away. The alternative may cost you double when that could have been thought through at the time of investment.

If you are only replacing an existing housing, you have a few more compatibility considerations. (1) Along with the consideration above of future-proofing your investment, you also have to consider (2) what pipe thread you have if you wish to direct connect, (2) quick-disconnect type, (3) transmitter type and size, (4) tooling fitment you have, and (5) what ground type you are drilling in. If you are not looking to change any of that, then these details will give you the information you need to make an informed housing purchase.

COMPATIBILITY IS IMPORTANT

Compatibility With the Make & Model of Your Rig

If you have been around the HDD industry long enough, you probably know that when you purchase a new Vermeer® rig that your likely going to get a deal on a DigiTrak Walk-over Locating System and if you purchase a new Ditch Witch® rig, a SubSite® locating system is preferred by the OEMs. Today, there are myriad adapters to transition from most Housings to lead rod, drill rod or drive chucks so it's not as big an issue as it once was. But, you will need to pay close attention to the Model drill rig and the thrust rating. Below is a table to reference to pair common Melfred Borzall Housings to different Rig Model's thrust rating:

Compatibility With the Make & Model of Your Transmitter

These housings are typically manufactured to accommodate one style and size of transmitter. If you are currently using a DigiTrak Falcon F5+ System, then ensure this housing is made specifically to accommodate the model of DCI Transmitter being used with the system. You don't want to purchase housing only to find out your transmitter is too long or short!

Drill Rig Thrust Rating*	Recommended Housing Diameter	Compatible Side-load, Bolt-on	Compatible Side-load, Thread-on	Compatible End-load, Thread-on
7,000 lbs and less	2.0"			2622-HT4
7,000 - 12,000 lbs	2.5"	5625-HT4-06, 5625-HT4-13	5625-HT4	
12,000 - 20,000 lbs	2.75"	5627-HT4-13	5627-HT4, 5927-HD4	
20,000 - 35,000 lbs	3.25"	5632-HT4-13	5632-HT4, 5932-HD4	
35,000 - 45,000 lbs	3.5"	5935-HD4-15	5735-HU4	ELH-350
45,000 - 90,000 lbs	4.25"		5742-HU4	ELH-425
90,000 - 140,000 lbs	4.75"		5747-HU4	ELH-487
140,000 - 300,000 lbs	6.38"			ELH-638

*These are meant to be approximate and can vary slightly between OEMs & rig models. Please verify your rig's thrust rating in all use cases.



AN EXAMPLE OF WHY DRILL RIG THRUST RATING MATTERS:

Assume you are running a JT24 and want to purchase a 4-1/4" transmitter housing for the main reason that it accommodates a 19" transmitter that you have left over from a previous job. There are some issues you will run into in trying to make this shortcut:

ISSUE 1

The drill rig thrust rating for a D24x40 Series 3 is 28,000 lbs of pullback force. Although the idea of saving money by reusing your 19" sonde from your previous job, the only housing that can accommodate that transmitter is a 4-1/4" housing that has working drill rig thrust compatibility of 40,000 - 80,000 lbs. Whatever money you save on a transmitter will be multiplied in expense to repair the damage to the rig's motor or drive train.

ISSUE 2

Also, the D24x40 S3 thread designation is not compatible with a standard adapter, quick-disconnect, or direct-connect configuration on this larger 4-1/4" housing. It's not standard for a reason...safety!

ISSUE 3

The only front tooling connection type available (without a bit body) for a 4-1/4" housing is a thread-on type of bit. Since this class rig often works with directional blades for better steering and other job-specific reasons, you may be risking slower production (which = more money) with a less-than-optimal tooling setup.



2

PART TWO

USE CASES & EXAMPLES OF
**DIFFERENT TYPES OF
TRANSMITTER HOUSINGS**



TRANSMITTER HOUSING TYPES

Now that you have asked yourself all the appropriate questions to know what you need for your job and equipment, let's take a deep dive into the different styles and types of transmitter housings, along with some of the features that distinguish them. Below is a Matrix of the different types of common transmitter housing you will find. We have neatly organized these housings into a matrix to identify which type of housing you should use...or avoid, depending on your job and ground conditions.

SIDE LOAD		END LOAD	
Bolt-on Housings	Thread-on Housings	High-flow Housings	Service Shot Housing
<ul style="list-style-type: none"> Pilot hole diameter is around 5-1/2 inches or less Need flexibility to change blade types for varying ground types Traditional or direct pullback applications When using a single 15" Transmitter 	<ul style="list-style-type: none"> Pilot hole diameter is around 7 inches or less Prefer flexibility to use thread-on bits or blades (with bit body) Traditional or direct pullback applications When you need a universal option that fits most transmitters 	<ul style="list-style-type: none"> Pilot hole diameter is > 6-1/2 inches When drilling with a mud motor Drilling long shots Using a cable transmitter 	<ul style="list-style-type: none"> Pilot hole diameter is < 4 inches When you need limited fluid for fast cleanup Using threadless tooling connection Connecting direct-to-drill rod

SIDE-LOAD TRANSMITTER HOUSINGS

There are essentially two ways to load your transmitter into a transmitter housing: loading it through the end of the housing where your tooling will thread onto (or "End-load"), or loading it into the side of the housing where there is a machined transmitter cavity that will fit your transmitter type (or "Side-load"). On the following page, we'll tackle side-load housings. These housings offer a secure and easy way to load and unload the transmitter without having to break apart your tooling connection or remove the housing from the drill string. Side load housings will come with a cavity lid that protects the transmitter, which you can attach with a roll pin or bolts. Some premium housings offer "double security" by offering both bolts and roll pin options.



SIDE-LOAD, BOLT-ON HOUSINGS



The bit connection differentiates these types of side-load housings. It accepts directional blades that bolt on (rather than thread-on bits, which we'll cover next). If you're asking yourself, "Why does this matter?" then you're on the right track. Bolt-on Housings are a great fit for the following ground and jobsite conditions:

BEST FOR THESE GROUND TYPES



Rarely do you have a circumstance where you start in one ground type, and there is absolutely no soil-type variance in depth or distance over the path of the bore. If you are unsure about your ground variations downhole, choose a bolt-on blade that can tackle some hard ground but gives you the versatility to move and steer quickly if the ground softens at some point. Blades usually have a bend that allows for quicker steering on a push as well as clearance for standard fluid nozzles on the end of the housing to help with the cutting action.

Some ground types that you may move between in a bore are cobble, sand, caliche, or even compact soils such as hardpan or sandstone. Helpful blades to mate with the bolt-on housing are steep-taper blades for soil puncturing during a directional push, dome-carbide blades for moving cobbles, or a full-carbide coverage blade for harder ground types. For more information about the differences between blades and ground types, check out our comprehensive blade guide.



BEST FOR THESE JOBSITE CONDITIONS

When drilling with a bit that is bolted to the housing, there is a certain rotational force that puts some wear on the blade. It can also put extra strain on the bolts holding the blade to the housing and risk shearing those bolts if the rotational force extends beyond the bolt's shear load capacity. Melfred Borzall has a patent-pending innovation, the Pit Bull Design, that increases the blade bolt's shear load capacity, but if your pilot bore needs to be too large, you may find a blade is insufficient. For pilot bores, under 6-½ to 7" is the sweet spot for blades. Barring uncommon specialty blades, you may want to think about opting for a thread-on housing + bit option if it is larger than that and the soil type is too compact.



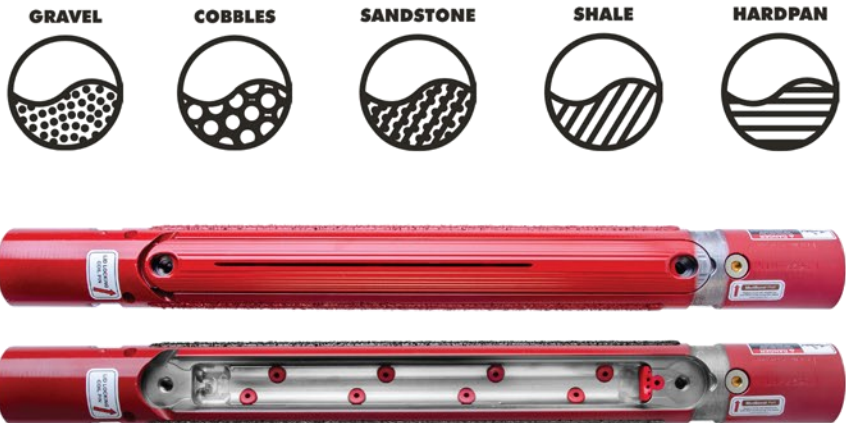
Also, because of the flat surface area of the blade, there is typically plenty of space to attach a bolt-on pulling link, device, or swivel if you want to make your pullback direct without removing the blade. Many housings, such as the Melfred Borzall SD housings, come equipped with built-in rear mud boost port and cutter block attachment areas, even if you opt not to use them to attach reamer-style cutters and convert the housing into a direct pullback reamer. In smaller diameter bores, sometimes the pilot or receiving pits are equally as small or tight, and having that direct pullback option on a blade can be a production dollar-saver.



SIDE-LOAD, THREAD-ON HOUSINGS



BEST FOR THESE GROUND TYPES



Thread-on bits are typically for harder ground conditions. Because there is a threaded connection between the housing and neck of the bit, it is able to withstand much higher RPMs and rotational force in tougher soil conditions. Instead of fluid traveling through nozzles at the end of the housing, it will usually travel up through the bit, and the bit should have a port and fluid jet holes to get it to the end of the drill string. The real decision-making point of whether you think you should opt for a bolt-on or thread-on side-load housing will ultimately depend on your job's requirement for bit type.



BEST FOR THESE JOBSITE CIRCUMSTANCES

One thing to keep in mind when selecting a housing is that there are options available to the side-load, thread-on housings that are not typically found in a bolt-on option that may give you more flexibility. For example, Melfred Borzall offers a "Universal" Side-load, Thread-on Housing that allows you to use most major transmitter models or 15-19" size transmitters.

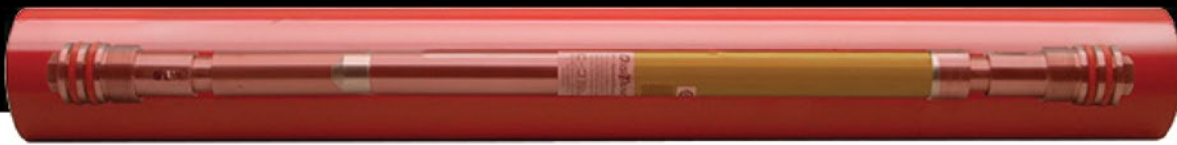
So, suppose your company has crews across the nation and is using various transmitter types. In that case, you have the option to use a single housing with any DCI®, Underground Magentics®, or SubSite™ transmitters (not 8" transmitters).

Another option that makes a thread-on housing more flexible is bit body attachments that convert your thread-on housing into a bolt-on housing. These are essentially bits that resemble the nose of a bolt-on housing with fluid nozzles (and Pit Bull™ pins if Melfred Borzall). With this, you can continue to use your blades if you run into ground that calls for it without having to purchase another housing.



END-LOAD TRANSMITTER HOUSINGS

In the early days of side-load housings, the argument against it was that the machining of a cavity into a solid cylinder of steel would weaken the housing, and it wouldn't hold up under intense rotational force. This argument was made because loading the transmitter into a housing through the end was the norm. While that may have been true decades ago, there have been major advancements in heat-treating and moly-alloy steel tempering that have leveled the playing field between side-load and end-load housings. So much, in fact, that rarely do we see a contractor opt for an end-load housing if they don't need it for one of the two specific applications that require an end-load housing. Let's review those two things here:



DRILLING WITH HIGH-FLOW HOUSINGS

Even though the quality and strength of side-load housings have made major advancements over the years, one thing is not changeable—the space that a transmitter cavity takes up in the side of the housing. Because there is a cavity machined into the side of the housing, the gun-drilled fluid passage holes must be limited in number and arranged so they do not interfere with the transmitter cavity. In a standard setup, the given number of fluid holes is plenty to keep your transmitter cooled and the proper amount of fluid flowing to the end for cutting action and proper slurry mixing downhole (if you adhere to manufacturer specs for fluid & pressure).

But when you get into something other than a “standard” setup, such as a mud motor that runs a tri-con roller bit, you'll need a higher flow of fluid to get to that bit. Enter the High Flow End-load Housing. Since the transmitter is inserted through the end into the center, there is no need for a separate sonde cavity. That means there is room to insert added fluid holes and for a higher flow rate of fluid. If you are running a mud motor, you will certainly need a high-flow housing.

DRILLING WITH CABLE HOUSINGS

The second circumstance that you will certainly need to consider using an end-load housing is when locating with a cable transmitter. Cable transmitters insert into your housing just like any other transmitter would, except there is a cable that extends out the back of the housing and runs up the inside of the drill rod to your rig's drive chuck. The benefit of this type of drilling is that it can provide consistent and important information such as inclination, tool face, position, temperature, and annular pressure without the risk of radio frequency interference.

Drillers in high-risk interference areas or drilling under bodies of water may choose to go with this option, which would require an end-loading of the transmitter into the housing so the cable can feed up the drill string.



3

PART THREE

HOUSINGS & COMPLETE DRILL HEAD SOLUTION

For this section, we are going to change how we approach transmitter housings. Let's take a higher-level viewpoint of the complete drill head setup and the housing as the central component of the system. We'll break down three main types of systems that utilize different transmitter housing types and when you should choose each.



THE DIRECT PULLBACK SYSTEM

Let's look at a system that really focuses on jobsite productivity on jobs that are not as big and hairy as drilling through hard shale or limestone. When your profitability is dependent on your day's high productivity, breaking out tooling and reconnecting can be a serious time (and money) drain. Some systems leverage your already-mated pilot shot tooling for the pullback as well. This means that you don't have to jump in the pit, break out a connection, reattach a reamer and swivel, and then pull back. With direct pullback systems, the pilot shot tooling is transformed into your pullback tooling without having to remove the drill head. There are several components to this that we have already nodded to earlier in this article, but here is a direct pullback system laid out:



1 DIRECT PULLBACK COMPATIBLE HOUSING

Use either a side-load, bolt-on, or side-load, thread-on housing type for this application. These housings usually will have an integrated fluid port in the tail and some flats with bolt holes to attach pullback cutters as shown to the right.



2 CUTTER BLOCKS

Attachments designed specifically for the transmitter housing that are staged up in size from front to back and widen the hole during pullback, transforming your housing into a reamer.



3 DIRECTIONAL BLADE OR THREAD-ON BIT

Your housing selection will determine whether you need a blade or bit. But don't wing it...the bit or blade is an important component for the pilot shot and determine what type of pullback device you will use.



4 PULLBACK DEVICE

This is the device that attaches to the bit or blade to connect a puller or swivel that is pulling the product. The type of device is dictated by your bit or blade choice.



EXTRA FLUID FLOW

Integrated ports and added adapters with extra fluid ports are necessary because the flow from the small housing nozzles is not enough if you are reaming the hole, and the material needs to be carried out of the hole through the drill fluid flow.



WHEN IS DIRECT PULLBACK THE RIGHT CHOICE?

A direct pullback system is made to cut downtime, but it has its limitations. If you need to drill anything larger than a 12" hole, you will want to go with a traditional reamer and swivel setup. While the direct pullback option is great for productivity, it is meant for specific applications.



WHEN SPACE IS LIMITED

Sometimes your pilot pit is no larger or deeper than foot or so. Direct pullback will allow you to have the space connect one cutter block at a time as you progress the rod. A luxury that decoupling a traditional reamer & re-threading it cannot provide when space is at a premium.



LARGE DIAMETER JOBS

Larger diameter bores that require larger bits and reamers than currently are available to use with a direct pullback system. If your job is typically larger than 12" in diameter you will want to start looking at traditional pullback options.



WHEN TIME = PROFITABILITY

Some HDD jobs are risky and complicated and take time to plan and adjust. But when you have a straightforward, smaller diameter job to put pipe in the ground and your profitability matters on how quickly it gets done...you will want to expedite your pullback process with direct pullback.



THE MUD MOTOR SYSTEM

In most drilling operations, the drilling fluid (often referred to as mud) used for directional drilling aids in the cutting, cooling, and flowing out cuttings. But with a mud motor, the pressure and flow of the fluid actually powers the drill bit to spin and cut. Yet, a mud motor utilizes this fluid in flow pressure to rotate the drill bit. This shifts the power source from the rig's hydraulic motor to the fluid itself. The entire system is made up of some key components:



1. THE MUD MOTOR

The drill fluid coming from the high-flow housing, up through your drill string and into the motor causes the rotor to spin inside the power section.

Power Section
Rotor/Stator

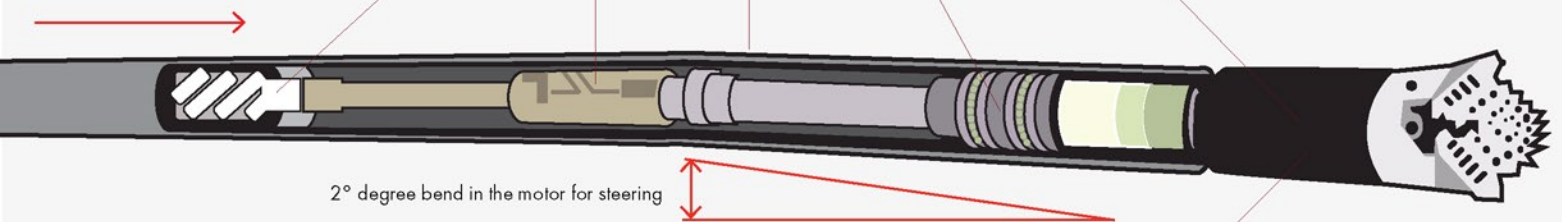
Universal Section
(Flexible Shaft)

Bent Sub

Sealed Bearing
Section

Bit Box

Rotational Power is transmitted from the Rotor all the way through to the Bit Box. This allows the drill bit to spin, without spinning the drill pipe.



2° degree bend in the motor for steering

The bit is always rotating, allowing for steering while drilling through solid rock

- Drill fluid flow = speed of rotation of the bit (rpm)
- Drill fluid pressure = torque output by the bit (lb-ft)



2. THE END-LOAD, HIGH-FLOW HOUSING



High-flow end-load housing IS THE ONLY TYPE OF HOUSING OPTION for mud motors. Do not attempt to use anything that does not have the fluid flow capacity as a high-flow housing. This is to protect the transmitter and enable the enormous amount of fluid that will need to get to the end.

WHEN IS A MUD MOTOR THE RIGHT CHOICE?



HARD ROCK

When encountering hard rock formations or solid rock Mud Motor may be the option to get you the best results. If you need to shear or fracture rock, and simple hard ground bit with a standard-flow housing may not cut it.



DRILL RIGS OVER 35,000 LBS *

As mentioned previously, it is imperative that your rig can handle the thrust and fluid flow of the job. The result of cutting corners may not just be a loss of productivity...it could also mean tooling & rig damage.

3. DRILLING FLUID ADDITIVES

Rock Drilling uses a lot of drilling fluid...and we mean a lot. You will typically see mud reclaimers and recyclers that are used to separate the mud and reuse the fluid so that there isn't so much waste. Rock drilling jobs often have a crew member designated as the mud specialist that keeps this operation running smoothly as well as keep the mud recipes on point.



4. SPECIALIZED BITS

PDC BITS

Polycrystalline diamond compact bits

- Fixed cutters that do not move
- Longer lifespan since no moving parts, bearings or seals
- Combine artificial diamonds and tungsten carbide
- Drill faster than tricone bits when in established rock formations and correct PDC is selected
- Good at shearing rock



TRICONE BITS

Most common in solid and loose rock

- 3 roller cones (moving parts)
- Action of the individual rollers on a tricone bit serves to fracture the rock
- Require lubricated bearings and a grease reservoir
- Softer formations use steel-tooth bits (Mill Tooth)
- Harder formations use tungsten carbide inserts (TCI)



THE SERVICE SHOT SYSTEM

Service line installations are typically very small-diameter service line installations in residential areas, such as gas lines coming off the main line from the street to the house. They are short, shallow bores, and contractors have to get multiple shots in a day to be profitable. A service shot system was designed to safely and efficiently expedite these scenarios that often involve other complexities, such as tight setup areas and congested mazes of existing (and sometimes unmarked) underground utilities. Below is the housing and components of system:

HOUSING & SYSTEM COMPONENTS



DIRECT-CONNECT PULLBACK

Threadless pulling eye option or reamer + pulling eye option with a Valu-DUB swivel

FASTER STEERING BIT

Increased angle on the steerface and tooth-free design decreases the risk of snagging unmarked utility

EASY SONDE LOCKING

Bit tab mates DigiTrak™ notch for clocking in the right direction

ROLL PIN SECURITY

Quick tap and go action to secure or release your sonde

DIGITRAK™ COMPATIBLE

Housing accommodates standard 15" Digitrak™ & U-Mag Sondes

SHORTER LENGTH HOUSING

Creates a shorter setup area when a short,, direct connect option is best

SPRING TENSION HOLD

Spring hold transmitter in place & limits vibration



WHEN IS **SERVICE SHOT** THE RIGHT CHOICE?

GO WITH A
 SERVICE SHOT SETUP

GO WITH A
 STANDARD SETUP

- I need an option to use limited fluid for faster cleanup
- I have a tight setup area & need a shorter, zero-point entry
- I need something without teeth that won't risk snagging unmarked utility
- I need to decrease my rod time from 10 minutes to 2 minutes
- We have multiple short shots we need to get done in a day
- I want a threadless solution for connecting bits



- We are drilling over 150ft in a single shot
- I need to run high RPMs for the ground I'm in
- I need to run a lot of fluid with a special mud mix for my ground type
- My ground type calls for carbide protection and cutter teeth on my bit
- I'll be pulling back greater than 10,000 lbs of utility on pullback



In our 78 years of manufacturing HDD tooling we have seen all kinds of ground conditions and situations that have tested our expertise. We see contractors succeed when they understand and choose the appropriate tool for the job at hand...the days of a one-size fits all are gone. We can do better than that.

- Peter Melsheimer



IN SUMMARY...

Whether it's soft soils, clay, cobbles, or challenging terrains, Melfred Borzall offers specialized transmitter housing solutions tailored to meet the diverse needs of your HDD projects. By leveraging the expertise and quality offered by a manufacturer like Melfred Borzall, drillers can ensure optimal performance, reduce downtime, and achieve successful outcomes.

As the field of HDD continues to advance, staying updated with the latest tools, techniques, and industry best practices is crucial. Our experts are happy to speak with you and help you make the best choice according to your site-specific factors, budget, and environmental considerations. There is a reason Melfred Borzall has remained one of the most trusted names in HDD manufacturing, and we are here to help you succeed in our fast-paced and demanding HDD industry.

*Only Melfred Borzall Transmitter Housings are represented in this guide. We do not make claims on compatibility with any other manufacturers' transmitter housings and recommend you consult a manufacturer for a specific make and model before drilling.

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