



Ramming technology for pipeline construction

Trenchless with GRUNDORAM

- *Crossings beneath roads, railways and rivers*
- *HDD Assist & Rescue*



TRACTO-TECHNIK



Superior without trenches

...safe & simple pipe installation



Setting up the Grundoram.

The ramming technique

Grundoram pneumatically driven pipe ramming machines are used for the dynamic installation of pipelines. These machines, which provide **thrust forces up to 40.000 kN** (4.000 t), enable the economic installation of open steel pipes as casing or product **pipes up to 4000 mm** diameter, over lengths up to 80 m in **soil classes 1 - 5** (partly even class 6 - easily soluble rock) without jacking abutments. The average installation speed is approx. 10 m/h.

The dynamic ramming impact shatters obstacles and easily overcomes difficult starting resistance after standstill periods. The soil gathered in the pipe is removed with air and/or water after the installation is completed.



Installation of steel pipes underneath roads, railway tracks, parks, trees, buildings up to ND 4000

Powerful

in almost any type of soil

...with dynamic impact



Grundoram Apollo in operation.

Advantageous

The technical and economical advantages of the ramming technique result from the fact that **abutments (in the rear, front or underneath) are not required**, thus shortening the set-up times. This technique also ensures that the pipe string is stably embedded in the ground as the structure of the surrounding soil is not loosened, this also makes **pipe installation in water-bearing and rocky soils** possible. Due to its very small displacement volume in the area around the cutting shoe, ground heave can be ruled out even with little cover.

At a glance:

- less disruption and damage to surfaces worth conserving and minimal restoration,
- low social costs because detours, half-sided barriers etc. are avoided,
- no jacking abutments or auger cutters required which could get jammed,
- the soil core remains in the pipe during ramming, i. e. no ingress, of water when rivers or high water table areas are encountered,
- minimal depth of cover required, i.e. shallower excavations,
- adaptable for all pipe diameters with special ram cones,
- widely acknowledged and accepted simple technique,
- short set-up and installation times,
- wide application range.



The world's most powerful ramming machine APOLLO with an impact energy of 40.000 Nm (400 t).

Project:

The NEL North European Natural Gas Pipeline distributes natural gas arriving from Russia to Germany and the rest of Northwest Europe. The natural gas storage unit in Rheden is the final arrival point for the gas pipeline. Stretching over a 440 km route from the North of Germany, the pipeline has to cross beneath countless roads, rivers and railway tracks.

Client:

WinGas, EON Rurgas, GasUnie

Main contractor (2 sections, each 60 km):

Bonatti S.p.A. Parma / Italy

Sub-contractor:

DALCAI Horizontale Wegboringen B.V.

7440 AA Nijverdal / Netherlands

Tel. +31(0) 5486 18382

www.dalcai.nl

Installation lengths:

3 crossings under streets, length each:

- in Perdöhl „An der Chaussee“, 34 m
- in Albertinenhof „Wittenburgerstraße, 40 m
- in Schwartow „Zarrentinerstraße, 44 m

Soil conditions:

compact, sandy soil

Characteristics:

Trenchless method for reasons of tree protection (old oak alley). Decision in favour of ramming technique as it's faster and cheaper than other methods.

Attachment of the cotter segments which prevent the pipe from flaring.



The Grundoram machine on a truck.



Transport of the pipe ram



The Grundoram is placed



and connected to the ste



Start of the ramming proc



at the jobsite.

position.

pipe.

s.



Steel pipe arriving on target.



Removal of the soil using water.

Watch the jobsite video online:

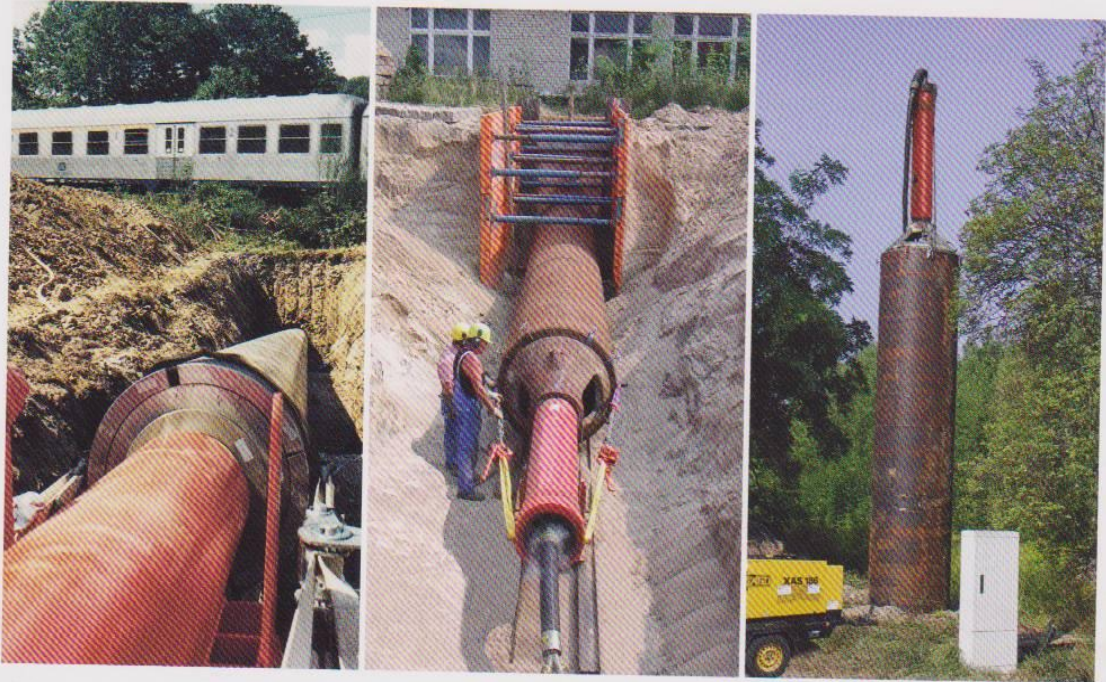




Versatile

for various applications

...horizontal and vertical



Almost anything goes

The ramming technique is suitable for installing longitudinally welded pipes
• spirally welded pipes • seamless pipes • pipes with insulation protection.
It is suitable in all soil conditions except for mud, marshes and non-displaceable solid soils, enabling a wide range of applications:

- Installation of steel pipes underneath buildings, roads, waterways, railway tracks, parks, etc.
- Vertical applications, e.g. for foundations, sheet piling or well drilling.
- Support of HDD bores (HDD Assist).
- Construction of pipe roofs for tunnel structures.

The wall thickness of the steel pipe must be in the correct ratio to:

- the ramming machine's impact power
- the installation length
- the pipe diameter



Construction of a pipe roof for a tunnel.



The completed tunnel underneath a railway track.

More on the GRUNDO-RAM application range:



Trouble free

project execution

... a clever combination



- HDD technique (static pulling force)
- + Ramming technique (dynamic impact)
- = Additional power for pipe pulling

HDD Assist & Rescue

When problems arise on a HDD project you need to act quickly to avoid a costly situation. Pipe ramming offers proven solutions for tough drilling problems.

The unrivalled percussive power of the Grundoram pipe rammer can help free jammed pipes and drill rods, overcome hydrolock, remove product pipes and more. Have a Grundoram on site during your next HDD project and ensure a trouble free installation.

Assist & Rescue techniques with Grundoram include:

- Conductor Barrel:
Installation of casing pipes for HDD crossings
- Pull Back Assist:
Overcoming hydrolock
- Drill Rod Recovery:
Loosening of jammed HDD drill rods
- Bore Salvage:
Rescuing / Removing jammed product pipes

HDD Assit job stories:





Sure start for your bore

...even in the worst soil

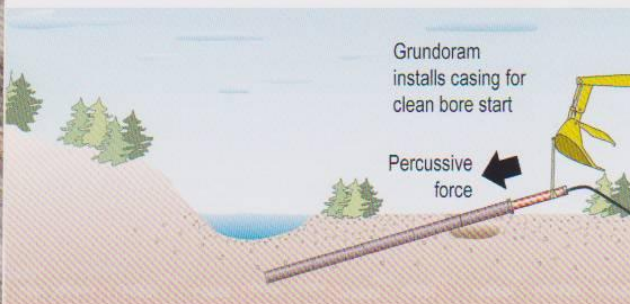
Conductor Barrel

The concept behind the Conductor Barrel is creating a clear pathway through poor soil conditions so that drilling can begin in more favourable soil conditions.

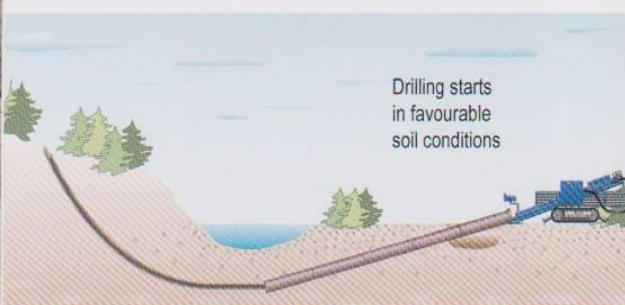
The success of a drilling operation can often be determined right from the outset. If drilling does not begin in soil that is conducive to drilling, the success of the entire project can be put in jeopardy. Loose, unsupported soils are prime candidates for this method. During the Conductor Barrel process, casings are rammed into the ground, at a predetermined angle, until desirable soil conditions are encountered. The spoil is removed from the casing prior to the drilling operation.



Drilling starts within the casing in the favourable soil conditions. The conductor barrel can also serve as a friction-free section during the pullback operation or prevent situations in unstable soils acting in a similar fashion to containment cells.



- Ram casings through difficult soil conditions to more favourable drill starting points.
- Guide down-hole tooling or mud motors to rocky soils through the Conductor Barrel.
- Provides a friction free section for product pullback.



Keep it moving

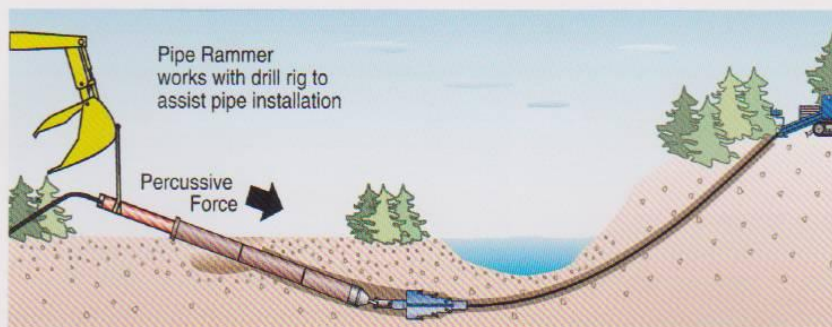
with percussive power

... and overcome hydrolock



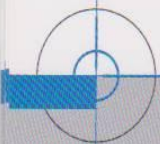
Pullback Assist

The pullback assist technique incorporates the use of both a Grundoram and an HDD rig working in tandem to get a problematic product pipe installed. When drilling underwater or in loose flowing soil conditions, hydrolock can occur. This happens when the external pressure being put on the product pipe from ground water pressure, drilling fluid pressure and/or soil conditions exceeds the drill rig's pullback capacity, or the product pipe's tensile strength. The percussive action of a Grundoram pipe rammer in this situation is used to help free the jammed pipe.



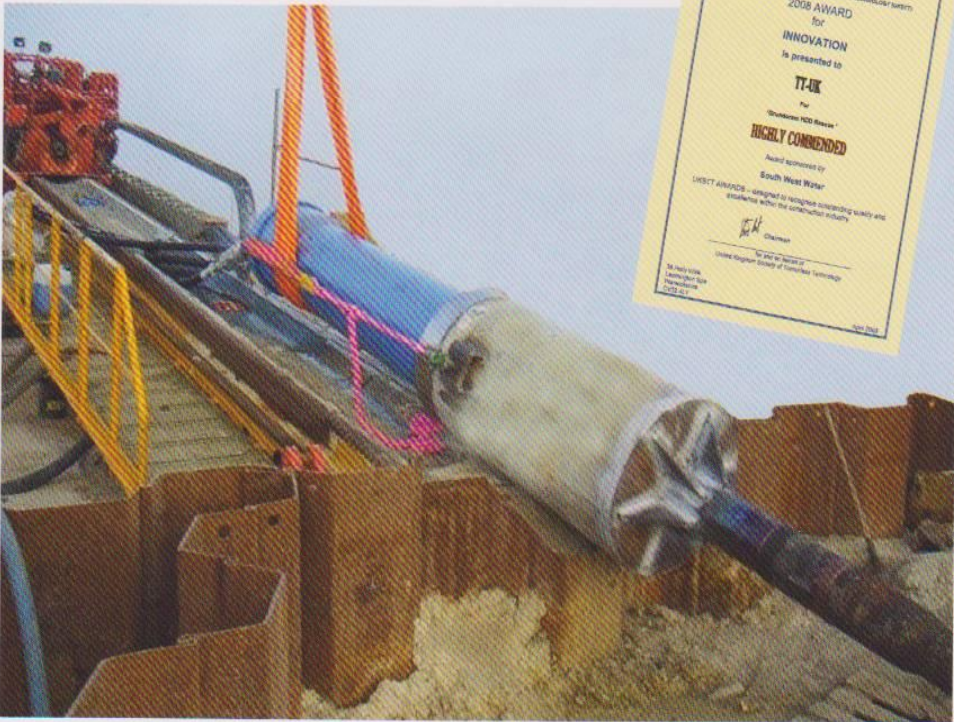
- Grundoram attached to product pipe during pullback.
- Percussive action keeps the pipe moving and helps prevent high levels of pullback stress.
- Percussive power frees jammed product pipes.

The pullback assist technique has been successfully used on steel pipe, as well as HDPE. This technique can be used as a safety measure in anticipation of hydrolock problems or after the pipe has become jammed.



Retrieve your drill rods

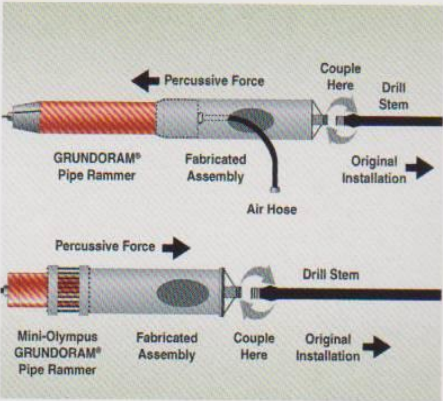
Don't get stuck



HDD Drill Rod Recovery

The principal is the same during drill rod recovery, as it is during bore salvage, however, there are two possible tooling configurations. Depending on the situation, contractors can remove the drill rod from the ground or, if the rod is still attached to the drill rig, push on the rod while the drill rig pulls back.

- Grundoram fitted with a special adaptor (fabricated assembly)
- Jammed drill rod welded to the back of the special adaptor
- Percussive power frees drill rods.



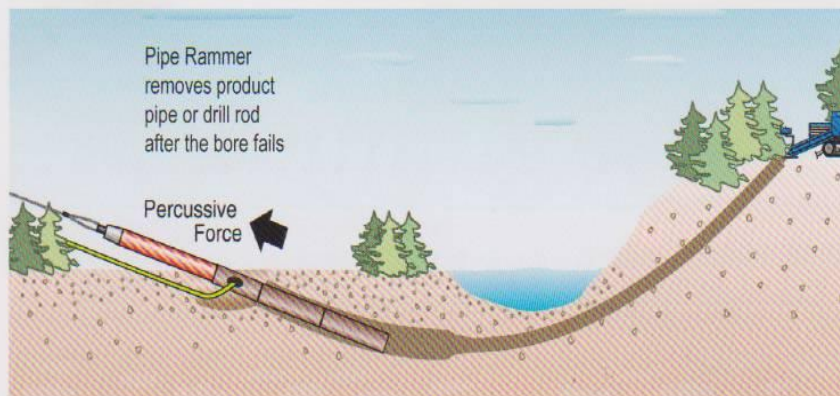
Remove stuck product pipes

... and bore again

Bore Salvage

This simple yet highly effective technique is used to remove jammed product pipes. During the bore salvage operation the Grundoram pipe rammer is attached to the end of the partially installed product pipe.

The pipe rammer is attached to the product pipe so that it pulls the pipe from the ground. This can be accomplished through a fabricated sleeve. A winch or some form of pulling device is used to assist the rammer during operation. In many cases, the percussive power of the pipe rammer is enough to free the jammed product pipe and allow it to be removed from the ground.



- Grundoram attached to product pipe after pullback fails.
- Percussive action pulls product pipe, removing it from the bore.
- Salvage the project and bore again.

Technical specification GRUNDORAM models*

GRUNDORAM	DAVID	ATLAS	TITAN	OLYMP	HERKULES	GIGANT	KOLOSS	GOLIATH	TAURUS	APOLLO
Machine-Ø (mm)	95	130	145	180	216	270	350	460	600	800
Rear cone (mm)	112	145	160	195	235	300	400	510	670	900
Length (mm)	1490	1453	1645	1690	1913	2010	2341	2852	3645	4400
Weight (kg)	59	95	137	230	368	615	1180	2465	4800	11500
Air consumption (m ³ /min)	1,2	2,7	4,0	4,5	6,5	12,0	20,0	35,0	50,0	100
No. of strokes (min ⁻¹)	345	320	310	280	340	310	220	180	180	180
Impact energy (Nm)	230	420	800	890	1440	2860	6820	11600	18600	40500
from pipe OD on	50	50	100	100	120	200	260	380	390	600

* Subject to change! Edition 01/01.2004. For data of Grundoram mini machines please contact us.



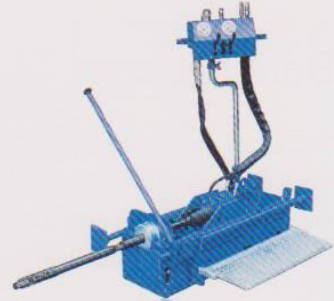
50 Years
TRACTO-TECHNIK
 1962 - 2012

TRACTO-TECHNIK

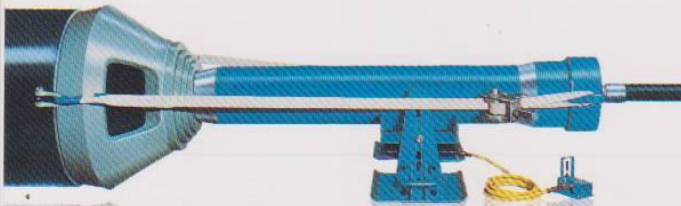
Product range



GRUNDOMAT - Soil displacement hammers
 16 models for installing pipes up to Ø 180 mm, since 1970
 New: GRUNDOMAT **N** with crowned head



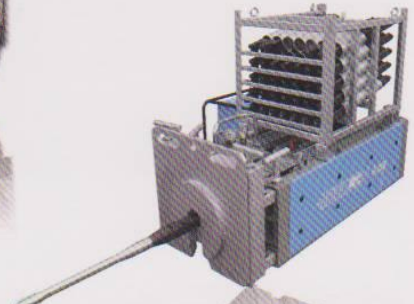
GRUNDOPIT "P" - Mini steerable bore rigs
 4 t pulling force, bores up to Ø 180 mm
 Models: Standard, Power, Manhole



GRUNDORAM - Steel pipe rammers
 for installations up to Ø 4000 mm
 13 models



GRUNDODRILL - HDD systems
 4 - 25 t thrust and pulling force
 for installing pipes up to Ø 700 mm
 Models: 4X, 15XP, 25N and
 rock drilling system 18ACS



GRUNDOBURST - Static pipe bursting systems
 Pipe renewal up to Ø 1000 mm
 Models: 400 G and S, 800G, 1250G, 1900G and 2500G



GRUNDOBORE - Guided auger boring units
 e.g. for gravity pipes
 Models: 200S and 400



GEODRILL - Bore rigs for geothermal heat extraction
 Model Geodrill 4R for radial bores and
 Geodrill 20V for vertical bores

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Germany:
 Tracto-Technik GmbH & Co. KG
 Tel: +49 (0) 27 23 80 80
 Fax: +49 (0) 27 23 80 81 89
www.tracto-technik.com
export@tracto-technik.de

United Kingdom:
 TT UK Ltd.
 Tel.: +44 (0) 1234 342 566
 Fax: +44 (0) 1234 352 184
www.tt-uk.com
info@tt-uk.com

USA / Canada:
 TT Technologies
 Tel.: +1 (0) 630 851 8200
 Fax: +1 (0) 630 851 8299
www.tttechnologies.com
info@tttechnologies.com

Australia:
 TT Asia Pacific Pty Ltd.
 Tel.: +61 (0) 7 3420 5455
 Fax: +61 (0) 7 3420 5855
www.tt-asiapacific.com
info@tt-asiapacific.com

France:
 Tracto-Techniques S.a.r.l.
 Tél.: +33 (0) 553 53 89 83
 Fax: +33 (0) 553 09 39 41
www.tracto-techniques.com
ttf@tracto-techniques.fr

Detailed product description and contact information at: www.tracto-technik.com