



Underground Products, Services and Reference Guide 2010

DYNO
Dyno Nobel

Groundbreaking Performance

Contents

 Services	4
 Bulk Explosives	6
 Packaged Explosives	8
 Initiation Systems	15
 Blasting Accessories	23
 Explosive Delivery Systems	27
 Reference	29

Why do companies come to Dyno Nobel for groundbreaking solutions?

Dyno Nobel is a global leader in commercial explosives and blast design. One of our core strengths is our understanding of the processes and challenges that impact on the mining industry. We leverage our decades of industry experience to meet and even exceed customer expectations.

We can draw upon our global resources to provide our customers with fully tailored solutions that can make a positive difference to any project.

Our Underground Mining Engineers are working with mining companies to solve highly complex problems and they can help you too. Only Dyno Nobel has the people, the resources and the experience both above and below the ground, to deliver groundbreaking performance.

Dyno Nobel is a business of Incitec Pivot Limited (IPL), an S&P/ASX Top 50 company listed on the Australian Securities Exchange (ASX). Dyno Nobel Asia Pacific provides a full range of industrial explosives, related products and services to customers in Australia and Asia.



Consulting services

DynoConsult®, the specialist consulting division of Dyno Nobel, aims to improve customer outcomes. Its resources include a team of experienced professionals with local and international experience in underground mining processes. DynoConsult is a high-technology group that can plan and implement an onsite review and importantly, recommend process improvements. Its focus is on outcomes that make a fundamental and positive difference, adding value where it counts the most – your bottom line. As a DynoConsult client, you benefit from partnering with a group that invests in the best people and has the resources and the vision to deliver results. The DynoConsult team offers specialised technical solutions across mining segments to optimise your mine processes. These include:

Minimising Ore Dilution and Loss. By monitoring and modelling underground blasts, DynoConsult can evaluate blast performance in conjunction with site personnel. This optimises blast design, product selection and charging practices through established processes to optimise recovery and dilution in underground mines.

Optimising Fragmentation for Mine to Mill™ Application. DynoConsult offers Mine to Mill blasting solutions which quantify the leverage that blast results have on different downstream processes and then generates improvements to optimise the overall performance.

Drill and Blast Auditing and Improvement Projects. Our DynoConsult team has a suite of audit tools to account for the differing nature of drill and blast operations across our industry. An integral part of this work is the auditing of drill and blast practices, to provide a baseline from which to measure improvement and assess progress against KPI's set as part of the project.

Emulsion Technologies. Dyno Nobel is able to provide a wide range of emulsion technologies for underground applications. These technologies have been used to maximise value in many different mining methods and applications. Emulsions deliver many benefits including:

- Improved blasting efficiencies (enabling drill pattern expansion),
- Minimising required high explosives magazine capacity,
- Lowering frequency and related costs for shipments,
- Lower security and safety risk,
- Improved fragmentation,
- Reduced product usage,
- High water resistance,
- The ability to increase 'sleep time',
- Reduced noxious gas emissions (potentially reducing re-entry times); and
- Reduced risk of sulphide dust ignition in susceptible conditions.

Up-hole Emulsions. Dyno Nobel can provide a world leading solution for up-hole charging using our patented technologies and proven formulations. These systems

have been used with great success in some of the world's leading operations, in both caving and open stope mines.

Development Solutions. Dyno Nobel also provides a range of emulsion solutions for underground tunnelling. Using a DynoMiner™ unit to efficiently deliver emulsion in development rounds, significantly improved drill and blast efficiencies can be delivered. Drilled metres per metre of advance will decrease with a reduction in the number of holes required to break the rock and improve advance in every round. Patented "String Loading" technology provides the ultimate in perimeter control. In addition to these benefits, using emulsion in development rounds means that one product is used for every hole eliminating the need for specific 'lifter' and 'perimeter' products.

Perimeter Control. Where emulsion charging does not offer the best overall solution for development tunnelling, Dyno Nobel is able to provide innovative products to improve loading and blasting efficiencies. Z-BAR® is a quick loading tube explosive with benefits in wet and dry conditions, offering a fully decoupled product for outstanding perimeter control (Z-BAR Edge) and a single pass loading system for lifters or wet holes (Z-BAR Lifter).

Tailored training courses

Only Dyno Nobel backs up its innovative product offering with world class support. Occupational health and safety has become complex, too complex for most organisations to manage without assistance.

To reinforce safe practices and upskill technical proficiency, Dyno Nobel offers a full range of training courses including the widely respected Optimal Drill and Blast Techniques for Underground Mining course.

Research & technology

New ideas in design and development and cutting-edge technology are what you expect from a global leader in explosives and blasting services. The combined experience and expertise of the teams within Dyno Nobel's Research & Technology Centres will ensure we retain our leadership position in providing technology-based solutions for the mining industry.

Customer Relations

Our Customer Relations team is trained to undertake and oversee order placement, source products, organise freight and process invoices.

For your convenience, orders can be placed by phone, fax or email.

Telephone Toll Free: **1800 251 872**

Facsimile: **07 3026 3999**

E-mail: dnap.customer.service@ap.dynonobel.com



In explosives, we are well known for our invention of dynamite. We followed this with the introduction of bulk slurry explosive and then packaged and bulk emulsions.

Dyno Nobel manufactures and has access to ammonium nitrate at strategic locations throughout the Asia Pacific region. Having the largest combined source of this critical raw material ensures we can meet your product demands.

ANFO (Bulk)



Properties:	
Density	
Poured (g/cm ³)	0.80 – 0.85
Pneumatically Loaded (g/cm ³)	0.85 – 0.95
Energy ¹ (MJ/kg)	3.7
RWS (%)	100
RBS	
Poured ² (%)	100
Blow Loaded ³ (%)	116
Recommended Minimum Diameter	
Poured (mm)	75
Blow Loaded (mm)	25
Water Resistance	Nil

1 All Dyno Nobel energy values are calculated using a proprietary Dyno Nobel thermodynamic code. Other programs may give different values.

2 Nominal poured density of ANFO of 0.82g/cm³.

3 Nominal blow loaded density of ANFO of 0.95g/cm³.

Description:

ANFO is a nominal 94:6 blend of prilled ammonium nitrate and diesel fuel oil. It is a dry free running product usually coloured for identification.

ANFO is dry and free flowing allowing delivery by either auger or blow loader.

The low bulk density of ANFO provides excellent charge distribution in the blasthole. ANFO provides excellent heave energy.

Application:

ANFO has a wide variety of applications in dry hole blasting conditions. It is one of the most cost effective blasting agents available for use in large hole diameter mining through to small hole diameter quarrying. Pneumatically loaded ANFO is also effective in underground development and tunnelling applications.

ANFO should only be used in dry holes. To realise the maximum energy available and reduce run up distances, it is recommended to prime ANFO with an HDP cast booster for all hole diameters. Depending on the application, ANFO may be primed with a suitable diameter detonator sensitive Powermite® Pro cartridge. The VOD of ANFO is dependent on the hole diameter, with VOD reducing as the hole diameter reduces.

Under normal conditions in dry, stemmed blast holes, ANFO may be slept for periods up to six (6) months. The sleep time may be limited to the recommended sleep time of the initiating system. The presence of water will dramatically reduce the sleep time.

ANFO has a maximum shelf life of six (6) months dependent on temperature and humidity conditions. Storage in a high humidity and high temperature environment will accelerate product breakdown and should be avoided.

Packaging:

ANFO is available in bulk through specialised truck delivery systems.

TITAN[®] 7000 Emulsion Gassed Blend Series



TITAN Emulsion 7000
Gassed Blend

TITAN 7000

Description:

TITAN[®] 7000 gassed blend emulsion products are water-resistant and designed to be pumped from the DynoMiner[™] Uphole (see page 27 for explosive delivery systems). The TITAN 7000 system uses the specialised ‘charging vehicle’ for applications in up and downholes. The truck is equipped with a dedicated boom and patented hose retraction unit.

Variants of TITAN 7000 are available for use in underground mining where sulphide ore reactivity (TITAN 7000i) and secondary dust explosions (TITAN 7000SX) are potential hazards.

Properties:

TITAN 7000 Gassed Emulsion	
Gassed Density (g/cm ³)	0.80 – 1.25
Energy ¹ (MJ/kg)	2.9
Recommended Minimum Diameter ² (mm)	40
Water Resistance	Excellent

1 All Dyno Nobel energy values are calculated using a proprietary Dyno Nobel thermodynamic code. Other programs may give different values.

2 Minimum hole diameter will vary with confinement.

Application:

The TITAN 7000 emulsion has been specifically formulated to provide excellent uphole retention. The emulsion has been developed for hole diameters 40 – 102mm, up to 30m in length.

The TITAN 7000 emulsion can be used at variable gassed densities of 0.8g/cm³ to 1.25g/cm³ providing control of bulk strength and explosive distribution as ground conditions vary. This permits blasting parameters to be optimised.

The loading methodology, together with the emulsion characteristics enable excellent uphole retention.

Complete coupling in the blast hole results in improved blast performance over packaged products and ANFO.

TITAN 7000 emulsion is advantageous over blow loaded ANFO with respect to water resistance, increased loading rates, higher shock energy, lower post-blast fume and improved fragmentation.

Packaging:

TITAN 7000 is available in bulk through specialised truck delivery systems.

Dyno Nobel manufactures a full range of explosives packaged products, for your underground mining needs. The tailored strengths and handling characteristics mean all underground blasting applications can be completed in the safest and most productive way.

ANFO (Bagged)



Description:

ANFO is a nominal 94:6 blend of prilled ammonium nitrate and diesel fuel oil. It is a dry free running product usually coloured for identification, delivery by loose pour or pneumatic loading. The low bulk density of ANFO provides excellent charge distribution in the blasthole. ANFO provides excellent heave energy.

Application:

ANFO has a wide variety of applications in dry hole blasting conditions. It is one of the most cost effective blasting agents available for use in large hole diameter mining through to small hole diameter quarrying. Pneumatically loaded ANFO is also effective in underground development and tunnelling applications.

ANFO should only be used in dry holes. To realise the maximum energy available and reduce run up distances, it is recommended to prime ANFO with an HDP cast booster for all hole diameters. Depending on the application, ANFO may be primed with a suitable diameter detonator sensitive Powermite® Pro cartridge. The VOD of ANFO is dependent on the hole diameter, with VOD reducing as the hole diameter reduces.

Under normal conditions in dry, stemmed blast holes, ANFO may be slept for periods up to six (6) months. The sleep time may be limited to the recommended sleep time of the initiating system. The presence of water will dramatically reduce the sleep time.

ANFO has a maximum shelf life of six (6) months dependent on temperature and humidity conditions. Storage in a high humidity and high temperature environment will accelerate product breakdown and should be avoided.

Packaging:

Bagged ANFO is available in packaged form varying from bulk bags (500kg) through to smaller plastic bags (10, 20 and 25kg). All bags are delivered as 1 tonne total product weight on a pallet i.e. 2 x 500kg, 100 x 10kg, 50 x 20kg and 40 x 25kg plastic bags per pallet.

Properties:

Density	
Poured (g/cm ³)	0.80 – 0.85
Pneumatically Loaded (g/cm ³)	0.85 – 0.95
Energy ¹ (MJ/kg)	3.7
RWS (%)	100
RBS	
Poured ² (%)	100
Blow Loaded ³ (%)	116
Recommended Minimum Diameter	
Poured (mm)	75
Blow Loaded (mm)	25
Water Resistance	Nil

1 All Dyno Nobel energy values are calculated using a proprietary Dyno Nobel thermodynamic code. Other programs may give different values.

2 Nominal poured density of ANFO of 0.82g/cm³.

3 Nominal blow loaded density of ANFO of 0.95g/cm³.

ANFO PS



Description:

ANFO PS is a low density form of ANFO specially developed for use where light explosive charging is required. ANFO PS is a 50:50 volume percent blend of ANFO to polystyrene and is delivered in orange coloured plastic bags.

ANFO PS can be either loose poured or pneumatically loaded in the blasthole. Pneumatic loading results in a higher density due to compaction and loss of polystyrene while loose pouring over long hole lengths is not recommended as ANFO/polystyrene segregation may occur.

Application:

ANFO PS can be used in a wide range of applications that demand the use of a low energy, well distributed charge in dry boreholes. The distribution of a light charge over the hole ensures that fragmentation is maintained whilst vibration problems are controlled. ANFO PS finds widespread use in perimeter blasting where reduced energy is required, especially in development/tunnelling to reduce overbreak and in stope blasting, etc, to reduce dilution and improve ground conditions.

It is recommended that low pressures be used to pneumatically load all ANFO PS mixtures in development and tunnelling to reduce segregation in the hole. Dyno Nobel recommends against pouring ANFO PS blends into long down holes due to the high probability of ANFO polystyrene segregation.

ANFO PS is not detonator sensitive. For loose poured applications, it should be primed with a suitable diameter HDP cast booster, when pneumatically loaded it can be primed with a Powermite® Pro cartridge.

ANFO PS has a maximum shelf life of six (6) months dependent on temperature and humidity conditions. Storage in a high humidity and high temperature environment will accelerate product breakdown and should be avoided.

Under normal conditions in dry, stemmed blastholes, ANFO PS may be slept for a period of up to three (3) months. In the presence of water the sleep time is dramatically reduced.

The sleep time of the blast hole is also limited to the recommended sleep time of the initiation system.

Packaging:

ANFO PS is available in packaged form in plastic bags.

ANFO PS is delivered in orange coloured plastic bags weighing 12.5kg. ANFO PS is delivered by pallet loads of 625kg product containing 50 bags.

Properties:

Explosives Class: 1.1D	U.N. No: 0082
ANFO:	
Polystyrene Ratio (Volume %)	50:50
Density	
Poured (g/cm ³)	0.46
Pneumatically Loaded (g/cm ³)	0.60
Energy ¹ (MJ/kg)	3.5
Recommended Minimum Diameter ²	
Loose Poured (mm)	62
Pneumatically Loaded (mm)	40
Water Resistance	Nil

1 All energy values are calculated using a proprietary Dyno Nobel thermodynamic code. Other programs may give different values.

2 Minimum hole diameter varies with ANFO density: Polystyrene ratio, product density and confinement.

BlastHi-T



Properties:

Explosives Class: 1.1D	U.N. No: 0082
Density	
Poured (g/cm ³)	0.80 – 0.85
Pneumatically Loaded (g/cm ³)	0.85 – 0.95
Energy ¹ (MJ/kg)	3.7
RWS (%)	100
RBS	
Poured ² (%)	100
Blow Loaded ³ (%)	116
Minimum Hole Diameter	
Poured (mm)	75
Blow Loaded (mm)	25
Water Resistance	Nil

1 All Dyno Nobel energy values are calculated using a proprietary Dyno Nobel thermodynamic code. Other programs may give different values.

2 Nominal poured density of ANFO of 0.82 g/cm³.

3 Nominal blow loaded density of ANFO of 0.95 g/cm³.

Description:

BlastHi-T is a nominal 94:6 weight blend of Dyno Nobel's prilled low density ammonium nitrate (Detaprill®), and mineral oil with a higher viscosity than diesel. It is a dry free running product, distinctively coloured for identification.

Application:

BlastHi-T has a wide variety of applications in dry hole blasting conditions up to 100°C, when implemented in conjunction with appropriate procedures. Compared to standard ANFO, the use of an oil component with a higher viscosity minimises fuel loss at higher temperatures, allowing an extended sleep time. Pneumatically loaded BlastHi-T is effective in underground development and tunnelling applications.

BlastHi-T should only be used in dry holes. To realise the maximum energy available and reduce run up distances, it is recommended to prime BlastHi-T with an HDP cast booster in all hole diameters. Depending on the application, BlastHi-T may be primed with a suitable diameter detonator sensitive Powermite® Pro cartridge. For specific priming requirements, please contact your Dyno Nobel representative. The VOD of BlastHi-T is dependent on the hole diameter, with VOD reducing as the hole diameter reduces.

BlastHi-T has no water resistance.

BlastHi-T has a maximum shelf life of six (6) months dependent on temperature and humidity conditions. Storage in a high humidity and high temperature environment will accelerate product breakdown and should be avoided. Signs of BlastHi-T degradation are hardening or caking which can lead to difficulty in loading and as a result, may lead to poor blasting performance.

Under normal conditions in dry and stemmed blast holes, BlastHi-T may be slept for periods up to six (6) months. The sleep time may be limited to the recommended sleep time of the initiating system. The presence of water will dramatically reduce the sleep time.

Packaging:

BlastHi-T is available in packaged form, ranging from bulk bags (500kg) through to smaller bags (10, 20 and 25kg). All bags are delivered on one (1) tonne product only weight pallets, i.e. 2 x 500kg, 100 x 10kg, 50 x 20kg or 40 x 25kg plastic bags per pallet.

Powermite® Pro



Properties:

Explosives Class: 1.1D	U.N. No: 0241
Typical Density (g/cm ³)	1.16 – 1.23
Energy	2.8 MJ/kg
Relative Weight Strength	121
Relative Bulk Strength	183
Velocity of Detonation* (m/s)	3400
Water Resistance	Excellent

* VOD is dependent on product density, diameter, the degree of confinement and other factors.

Description:

Powermite® Pro is a detonator sensitive gassed emulsion explosive, packaged in plastic film cartridges.

Application:

Powermite Pro is formulated as a high energy explosive for use in hard blasting conditions. This product has also demonstrated excellent performance in lifter holes in underground mining operations. It may be used as a primer of ANFO, Heavy ANFO and ANFO PS in small diameter boreholes.

Powermite Pro is formulated to be sensitive to a No. 8 strength detonator. The preferred method of initiation is via the NONEL® system. When inserting the detonator into cartridge always use a wooden skewer, not the detonator, to break the plastic film.

Powermite Pro products have a recommended maximum shelf life of one (1) year when transported and stored under ideal conditions.

The sleep time of Powermite Pro will be limited to the recommended sleep time of the explosive it is priming or that of the initiation system, whichever is shorter.

Packaging:

Powermite Pro	Cart Weight (kg)	Nominal Cartridges per Case
25mm x 200mm	25	209
25mm x 700mm	25	59
32mm x 200mm	25	133
32mm x 700mm	25	38
55mm x 400mm	25	23
65mm x 400mm	25	17
80mm x 400mm	25	11

SANFOLD®



Properties:

Explosives Class: 1.1D	U.N. No: 0082		
Sticky ANFO:			
Polystyrene Ratio (Volume %)	70:30	50:50	30:70
Density			
Poured (g/cm ³)	0.75	0.55	0.30
Pneumatically Loaded (g/cm ³)	0.87	0.67	0.54
Energy ¹ (MJ/kg)	3.63	3.51	3.28
Recommended Minimum Diameter ²			
Loose Poured (mm)	40	50	50
Pneumatically Loaded (mm)	32 – 40		

1 All Dyno Nobel energy values are calculated using a proprietary Dyno Nobel thermodynamic code. Other programs may give different values.

2 Minimum hole diameter will vary: Polystyrene content, product density and confinement.

Description:

SANFOLD® is a low density explosive designed to overcome segregation problems during loose pouring and pneumatic loading of explosive product. It has a TITAN® emulsion matrix content in addition to the ammonium nitrate, polystyrene beads and fuel oil components.

The TITAN emulsion in the formulation binds the ANFO and polystyrene together making the product ideal for use in inclined holes where segregation could occur whilst the sticky nature of the product keeps the explosive in the blasthole.

SANFOLD is therefore particularly suited to perimeter blasting in uphole stopes, with the different blends allowing the explosive properties to be matched with the particular geology.

Application:

The SANFOLD range of products provides a variety of explosive strengths for applications that require lower strength explosives such as in perimeter blasting. The lower energy of SANFOLD combined with its excellent charge distribution is designed to minimise vibration and maintain wall control whilst still achieving good fragmentation.

SANFOLD is formulated both for use in upholes as well as horizontal or slightly inclined holes in drives. SANFOLD is also suitable in steeply inclined holes as product segregation is minimised due to the emulsion binding the ANFO and polystyrene beads together.

SANFOLD is not detonator sensitive. It must be primed with a suitable diameter HDP cast booster or Powermite® Pro cartridge.

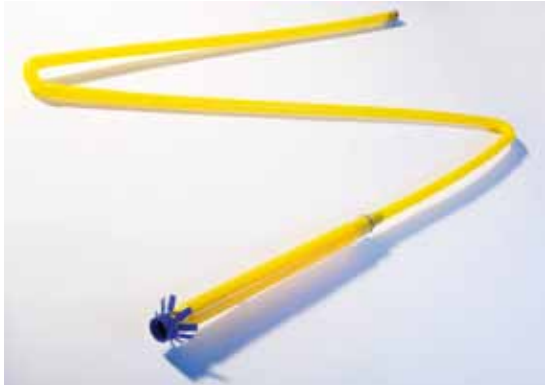
SANFOLD products should be used within three (3) months where possible. The maximum storage life for SANFOLD is six (6) months under ambient temperature and low humidity conditions. Storage in high humidity and temperature cycling conditions will accelerate product breakdown and should be avoided.

Under normal conditions in dry stemmed blastholes, SANFOLD may be slept for up to three (3) months. The sleep time will be limited to the recommended sleep time of the initiating system. The presence of water will dramatically reduce sleep time.

Packaging:

SANFOLD is available in packaged form in plastic bags. SANFOLD 70, 50 and 30 are available in 18kg, 12.5kg and 8kg plastic bags coloured green, purple and yellow respectively. SANFOLD 70, 50 and 30 is delivered in 50 bag per pallet loads containing 900kg, 625kg and 400kg of product respectively.

Z-BAR® Edge



Description:

Z-BAR® Edge is a contour product, designed to deliver the perfect solution for precision perimeter blasting in wet or dry underground developments. It is a high strength packaged explosive produced in a continuous tube form to be used as a decoupled perimeter product. It is detonator sensitive and has 10g/m detonating cord running internally through the entire length of the product.

Application:

Z-BAR Edge has been specifically designed to provide an easy-to-use and effective system, for perimeter blasting in underground development rounds.

Z-BAR Edge is sensitive to a No. 8 strength detonator or greater. The preferred method of initiation is via the NONEL® system.

Whilst holding the primer section of the Z-BAR tube charge, insert the NONEL detonator fully into the detonator well, located at the end of the primer section. The NONEL tube should be secured into the notch, located in the rim of the detonator locator.

While holding the first length of tube with the detonator locator, rip the tape from around the Z-BAR tube and let the remaining tube lengths drop.

Insert the primer section of the Z-BAR tube into the collar of the blasthole and push it in until the tube end is flush with the collar.

Using the ANFO hose, push the Z-BAR charge fully to the toe of the blasthole. The Z-BAR tube charge must be contained fully within the blasthole, with a gap left to the collar of the blast hole. This will minimise failures due to “suck out”.

Packaging:

Diameter – Tube (mm)	19
Diameter – Primer (mm)	35
Colour	Yellow
Nominal Box Weight (kg)	20 (maximum)

Properties:	
Explosives Class: 1.1D	U.N. No: 0082
Typical Density (g/cm ³)	0.90 – 0.95
Charge Weight – Tube (kg/m)	0.27
Charge Weight – Primer (kg/m)	0.77
Velocity of Detonation ANFO (m/s)	Dependent on detonating cord VOD
Detonating Cord (m/s)	6500
Water Resistance	Excellent

Length (m)	Quantity per Box	Length per Box (m)
2.5	20	50
3.0	18	54
3.5	16	56
4.0	13	52
4.5	12	54

Z-BAR[®] Lifter



Description:

Z-BAR[®] Lifter is a contour product, designed to deliver the perfect solution for precision floor blasting in wet or dry underground developments. It is a high strength packaged explosive produced in a continuous tube form to be used as a decoupled perimeter product. It is detonator sensitive and has 10 g/m detonating cord running internally through the entire length of the product.

Properties:

Explosives Class: 1.1D	U.N. No: 0082
Typical Density (g/cm ³)	0.90 – 0.95
Charge Weight (kg/m)	0.05
Velocity of Detonation ANFO (m/s)	Dependent on detonating cord VOD
Detonating Cord (m/s)	6500
Water Resistance	Excellent

Application:

Z-BAR Lifter has been specifically designed to provide an easy-to-use and effective system, for floor blasting in underground development rounds.

Z-BAR Lifter is also uniquely suited to development blasting where the ground is wet and suited to a high heave product.

Z-BAR Lifter is sensitive to a No. 8 strength detonator or greater. The preferred method of initiation is via the NONEL[®] system.

Whilst holding the primer section of the Z-BAR tube charge, insert the NONEL detonator fully into the detonator well, located at the end of the primer section. The NONEL tube should be secured into the notch, located in the rim of the detonator locator.

While holding the first length of tube with the detonator locator, rip the tape from around the Z-BAR tube and let the remaining tube lengths drop.

Insert the primer section of the Z-BAR tube into the collar of the blasthole and push it in until the tube end is flush with the collar.

Using the ANFO hose, push the Z-BAR charge fully to the toe of the blasthole. The Z-BAR tube charge must be contained fully within the blasthole, with a gap left to the collar of the blast hole. This will minimise failures due to “suck out”.

Packaging

Diameter (mm)	29
Colour	White
Nominal Box Weight (kg)	25 (maximum)

Length (m)	Quantity per Box	Length per Box (m)
2.5	15	37.5
3.0	12	36.0
3.5	10	35.0
4.0	9	36.0
4.5	8	36.0

In initiation systems, it all started with the invention of safety fuse and then, the detonator. Dyno Nobel has a range of superior detonators, including the NONEL[®] non-electric initiation system and the SmartShot Electronic detonator system.

TROJAN[®] SPARTAN Cast Booster



Description:

TROJAN[®] SPARTAN Cast Boosters are detonator sensitive, high density, high energy molecular explosives available in various sizes designed to optimise initiation of all booster sensitive explosives.

Features & Benefits:

- The explosive composition achieves high detonation pressure and provides excellent priming efficiency.
- The range of sizes available provide priming solutions for most blast hole applications.
- The TROJAN SPARTAN Cast Booster will accept NONEL[®] non-electric and SmartShot electronic detonators.
- The TROJAN SPARTAN Cast Booster is recessed at one end to provide protection to the initiation line.

Properties:	
Density (g/cm ³) Avg	1.65
Velocity (m/s)	7,300 (24,000 ft/s)
Detonation Pressure (Kbars)	220
Water Resistance	6 months with no loss of sensitivity
Shelf Life Maximum	5 years (from date of production)
Maximum Water Depth (m)	90 (300 ft)
Maximum Usage Temperature	70°C (150°F)

TROJAN[®] NB Universal Cast Booster



Description:

TROJAN[®] NB Universal Cast Booster is a detonator and detonating cord sensitive, high density, high energy, molecular explosive available in a 400g size. The TROJAN NB Universal is especially designed to optimise initiation of all cast booster sensitive and/or detonator sensitive explosives.

Features & Benefits:

- The explosive composition achieves high detonation pressure and provides excellent priming efficiency.
- The TROJAN NB Universal Cast Booster will accept PRIMACORD[®] 4, NONEL[®] and SmartShot electronic detonators.
- The TROJAN NB Universal Cast Booster is recessed at one end to provide protection to the initiation line.

Properties:	
Density (g/cm ³) Avg	1.60
Velocity (m/s)	7,800 (25,600 ft/s)
Detonation Pressure (Kbars)	245
Water Resistance	6 months with no loss of sensitivity
Shelf Life Maximum	5 years (from date of production)
Maximum Water Depth (m)	90 (300 ft)
Maximum Usage Temperature	70°C (150°F)

Detonating Cord: PRIMACORD® 5



Description:

PRIMACORD® 5 detonating cords are flexible linear explosives with a core of PETN explosive encased in an outer jacket. PRIMACORD detonating cords are encased in a textile jacket.

Application:

PRIMACORD 5 detonating cord has been designed for use as surface and downhole initiating lines.

Properties:

Explosives Class: 1.1D	U.N. No: 0065
Explosive Type	PETN.
Velocity of Detonation (m/s) (min)	6500
Colour/counter	Red/2 Black
Nominal Core Load (g/m)	5.3
Nominal Diameter (mm)	4.2
Minimum Strength (kg)	68

Packaging:

Length per Spool (m)	500
Spools per Case	2

Detonating Cord: PRIMALINE® 10



Description:

PRIMALINE® 10 detonating cords are flexible linear explosives with a core of PETN explosive encased in an outer jacket. PRIMALINE 10 detonating cords are encased in a plastic jacket.

Application:

PRIMALINE 10 is used for side initiation of explosives and may be used in combination with PRIMACORD 5 detonating cord.

Packaging:

Length per Spool (m)	350
Spools per Case	2

Properties:

Explosives Class: 1.1D	U.N. No: 0065
Explosive Type	PETN.
Velocity of Detonation (m/s) (min)	6500
Colour/counter	Red
Nominal Core Load (g/m)	10.6
Nominal Diameter (mm)	4.7
Minimum Strength (kg)	68

Electric Super Starter



Properties:	
Shell Material	Aluminium
Shell Length	60mm (2.375 in)
Leg-wire Material	Copper (single)
Leg-wire Colour	Turquoise/Yellow
Maximum Water Depth	76m (250ft)
Shelf Life Maximum	5 years (from date of production)
Maximum Usage Temperature	70°C (150°F)
Net Explosive Content per 100 units	0.0730 kg (0.1610 lb)

Description:

Electric Super Starter is an instant electric detonator housed in a plastic bunch block, facilitating easy connection to both shock tube and detonating cord. Electric Super Starter leg-wires are insulated with a superior polyolefin material which offers excellent resistance to cuts, abrasion, oil, low temperature and high humidity as well as other harsh environments in various rugged blasting applications.

The Dyno Nobel shunt protects the factory stripped wire ends from corrosion and shields them from stray current.

Application:

- NEVER use an Electric Super Starter detonator with other Dyno Nobel electric detonators or electric detonators from another manufacturer. Wiring different brand electric detonators together in a blast circuit may result in misfires.
- ALWAYS use Electric Super Starter in accordance with state laws and regulations.
- ALWAYS test Electric Super Starter before use by approved blasting circuit testers.
- ALWAYS initiate Electric Super Starter using approved firing devices only.
- Leg wires should remain 'shunted' until final hook up.

Packaging:

Units per Case 150

NONEL® EZTL



Properties:

Explosives Class: 1.1B	U.N. No: 0360
NONEL Tube Colour	Yellow
NONEL Tube Diameter (mm)	3.0 (STD)
NONEL Tube	
Velocity of Detonation (m/s)	2100 ± 300
EZTL Connector Block Capacity	6 STD tubes

Note – The EZTL will not reliably fire detonating cord.

Description:

The NONEL® EZTL initiation system is a low strength surface detonator series.

NONEL EZTL units consist of a length of yellow NONEL shock tube attached to a low strength, non-electric millisecond delay detonator that is factory assembled into a colour-coded plastic EZ connector block on one end and sealed with a plastic cord clip attached to the other end. The NONEL EZTL surface detonator can reliably initiate up to 6 shock tube leads clipped into the EZ connector block and the block design makes surface tie-in simple.

Application:

The NONEL EZTL initiation system is a low strength surface detonator series used in conjunction with the NONEL MS series to provide flexible, easy-to-use surface initiation system in mining and construction applications.

Packaging:

Length (m)	Units Per Case	Configuration
4.8	150	Coiled
6.0	150	Coiled
7.2	150	Coiled
9.0	100	Figure 80
12.0	75	Figure 80
15.0	75	Figure 80
18.0	50	Figure 80

NONEL[®] LP Series



Properties:	
Explosives Class 1.1B	U.N. No: 0360
Detonator	No. 12 Strength
NONEL Tube Colour	Yellow
NONEL Tube Diameter (mm)	3.0
NONEL Tube Velocity of Detonation (m/s)	2100 ± 300

Description:

The NONEL[®] LP detonator is a long period, high strength delay detonator series featuring 19 delays ranging from 25 to 8000 milliseconds.

Application:

The NONEL LP series provides an excellent in-hole initiating system appropriate for underground mining and construction applications. Used in conjunction with 5.0g/m detonating cord, effective and accurate in-hole long period timing sequences are available. Colour coded and stamped cord clips allow for easy identification.

Packaging:

Length (m)	Case Count	Configuration
4.8	200	Sidewinder
5.4	175	Sidewinder
15.0	75	Sleeve
24.0	30	Spool
36.0	30	Spool

NONEL[®] MS Series



Properties:	
Explosives Class: 1.1B	U.N. No: 0360
High Strength Detonator	No. 12 Strength
NONEL Standard	Red
NONEL HD	Orange
NONEL Tube Diameter (mm)	3.0
NONEL HD	3.0
NONEL Tube Velocity of Detonation (m/s)	2100 ± 300

Description:

The NONEL[®] MS detonator is a millisecond, high strength delay detonator series featuring 28 delays ranging from 25 to 1000 milliseconds.

Application:

The NONEL MS Series provides an excellent downhole initiating system appropriate for all mining applications. When used in conjunction with surface delays, the NONEL MS gives effective and accurate downhole timing sequences.

Packaging:

Length (m)	Units Case	Configuration
6.0	150	Coiled
7.2	150	Coiled
9.0	100	Coiled
12.0	75	Sleeved
15.0	75	Sleeved
18.0	50	Sleeved
24.0	30	Spoiled
30.0	30	Spoiled
36.0	30	Spoiled
45.0	30	Spoiled
60.0	30	Spoiled
80.0	30	Spoiled

TROJAN Ringprime® Cast Boosters



Properties:	
Explosive Type	PETN/TNT
Nominal Density (g/cm ³)	1.62 ± 3%
Ideal Velocity of Detonation (m/s)	7300
Ideal Detonation Pressure (kBar)	216
Nominal Mass (g)	250 ± 5
RINGPRIME	
Diameter (mm)	37
Length (mm)	175
SPIDER	
Hole Diameter 125 (mm)	64 – 102
Hole Diameter 187 (mm)	100 – 159

Description:

The TROJAN Ringprime® Cast Booster is a high density, high detonation pressure booster cast into a plastic shell. It has a single tunnel and cap, located centrally in the booster.

Application:

The TROJAN Ringprime booster is specifically designed for use in underground angled or vertical upholes. It is ideal for priming 64mm to 159mm upholes loaded with ANFO, cartridge or bulk emulsion products.

Packaging:

Ringprime (Units per Case)	42
Nett Case Weight (kg)	10.5
Case Dimensions (mm)	180 x 330 x 330
Spider (Units per Case)	70 (separate)

SmartShot Electronic Detonator System



Description:

SmartShot is the latest development in DetNet's suite of precision electronic initiation systems. The SmartShot system offers innovative features including the leaky feeder, wireless remote blasting system and complete timing flexibility. Specialised waterproof and dirt displacing connectors ensure quick, easy and reliable connections, and prevent leakage.

Detonator:	
Dynamic Shock Resistance	>12,000psi 500ns pulse width
ESD Resistance	Passes EN 13763-13
RF Immunity	Passes CEN TS 13763-27
Detonator Shell	Copper
Detonator Strength	8D (I.M.E.:#12) Strength
Base Charge	PETN
Net Explosives Quantity (NEQ)	0.1kg (0.2205lbs) per 100 detonators
Timing	Fully programmable & Auto-programmable
Connector	Rugged, water-resistant
Tensile Strength	>250N / 56lbs
Detonator Shell Marking	Dangerous – Blasting Cap – Explosive Danger – Detonateur – Explosif

Packaging:

UN Shipping Classification	1.4S
Detonator Configurations	Coil
Cable Colour	Green with a coloured stripe

System Limits:

Maximum Total Delay Time	20,000ms
Maximum Number of Detonators with Expander Module	1600* 2400*
Lead-in Length (wire)	2,000m

SmartShot Accessories:

	Units per Box	Packaging Dimensions (mm)
SmartShot Base Station	1	523 x 375 x 260
SmartShot Bench Box	1	523 x 375 x 260
String Starters & End Plugs	10	200 x 165 x 92
Smart Keys	3/5	146 x 86 x 38
Tagger Lite	1	300 x 250 x 140

SmartShot Detonators:

Downline x Surface Length (m)	Units per Case	Packaging Dimensions (mm)	Shipping Classification
10 x 7	18	480 x 215 x 245	1.4S
20 x 10	18	480 x 215 x 245	1.4S
20 x 15	18	480 x 215 x 245	1.4S
35 x 0.2	18	480 x 215 x 245	1.4S
45 x 0.2	18	480 x 215 x 245	1.4S
60 x 0.2	8	480 x 215 x 245	1.4S
80 x 0.2	6	480 x 215 x 245	1.4S

*Dependent on shot layout, please refer to training manual before use.

Dyno Nobel has a range of innovative blasting accessories for use with our initiation systems.

Detonating Cord Cutters



Description:

The Detonating Cord Cutter is a single acting, heavy duty approved cutting tool, with a long life stainless steel blade and synthetic anvil.

Application:

Detonating Cord Cutters are used for cutting detonating cord and NONEL® tube.

Packaging:

Sold in single units. Holsters are also available.

DynoTracker



Description:

The DynoTracker is a device that attaches to the end of a standard charging hose used for loading ANFO. This device allows the use of ANFO as a perimeter charge in tunnelling applications. Hereby eliminating more expensive cartridged explosives.

Application:

ANFO is blow loaded through the DynoTracker similar to the normal blow loading technique. It loads a partially loaded (decoupled) charge of ANFO into low inclination drillholes such as those employed in jumbo development mining. The decoupled charge produces a low order explosion when the primer detonates. This is ideal for the control of perimeter blasting, resulting in smoother tunnel walls with less overbreak.

Packaging:

Sold in single units.

J Cord Cutter



Description:

The J Cord Cutter is a drag knife for cutting detonating cord & NONEL® tube. Low cost, limited life tool with no moving parts.

Application:

Approved cutting device for initiation products.

Packaging:

Sold in bundles of 10.

Heavy Duty Firing Cable



Description:

The Heavy Duty Firing Cable is a twin multi-stranded, double insulated, heavy duty, low resistance cable for blast initiation, where a long-term fixed installation is available.

Application:

Fixed installations for electric initiation.

Packaging:

100m rolls.

Properties:

Insulation Colour	Red – Fig 8 outer sheath, Red and White core
Roll Size	100m
Number of Cores	2
Electrical Resistance @ 20C(mΩ/m) per core	12.9

Twin Twist Bell Wire



Description:

The Twin Twist Bell Wire is a spool of two single strands of copper wire, coated with PVC. The wires, one red and one white, are twisted around each other.

Application:

Twin Twist Bell Wire is suited to the extension of lead lines and the make up of firing circuits.

Packaging:

500m rolls.

Properties:

Conductor:	2 x 0.61mm diameter copper wire
Insulation:	PVC
Colour:	Red and White
Amp Rating:	1.8
Insulation Thickness:	0.40mm
Resistance:	62mΩ/m per core
Nominal O.D:	2.8mm

Scorpion®



Description:

The Scorpion® is a device used to centralise detonators in the borehole. Constructed from extruded plastic, Scorpion comprises four fins attached to a central spine and allows direct priming of ANFO in small diameter, dry blastholes – used in tunnelling and underground mine development to initiate blow loaded ANFO and TITAN 7000 bulk emulsion.

Application:

The Scorpion is designed to centrally locate and protect a detonator in the blast hole. When used in conjunction with a NONEL® LP or MS detonator, the No. 12 strength cap provides adequate priming performance to initiate blow loaded ANFO and TITAN 7000 bulk emulsion.

Properties:

Length (mm)	130
Diameter (mm)	38
Construction	Extruded Plastic

Packaging:

50 per bag.
600 per box.

Stempac



Description:

The Stempac device is an assembly of Stemtite plugs and selected crushed aggregate. These components are contained in a package manufactured from a deformable material. The deformable material permits the Stempac to increase its diameter to fit variations in the designated blasthole diameter.

Application:

To facilitate a means to stem blast holes that have been drilled horizontal or at an angle above horizontal. The Stempac is designed to be placed in a blast hole after the loading has been completed and is placed 80 cm below the explosive column.

Packaging:

The Stempac is delivered enclosed in a plastic sleeve and packaged in cartons. Each carton has a nominal weight of 30 kilograms. It is available in sizes to suit 76, 89 and 102 millimetre diameter blastholes.

Hole size (mm)	Quantity per box
76	14
89	10
102	8

Stinger Exploder 10 Shot



Description:

The Stinger Exploder SB10 is a compact capacitive discharge exploder.

Application:

The Stinger Exploder 10 Shot is suited for use in open cut and underground mining conditions, except in explosive atmosphere conditions.

Properties:

The Stinger Exploder 10 Shot will reliably fire up to 10 standard electric detonators in series with maximum circuit resistance of 36Ω.

Lo-Stat ANFO Hose



Description:

The Lo-Stat ANFO Hose is a conductive thermoplastic tube used for delivery of explosives in underground applications.

Application:

Blow loading ANFO in development rounds, production rounds and upholes.

Packaging:

60m coils.

Properties:		
	20mm hose	25mm hose
Internal Diameter (mm)	18.4mm – 19.6mm	24.6mm – 25.4mm
Outside Diameter (mm)	26.4mm – 27.6mm	29.8mm – 30.2mm
Wall Thickness (mm)	3.7mm – 4.4mm	2.3mm – 2.7mm
Resistance/metre (kΩ)	15 – 25kΩ	15 – 25kΩ
Total Resistance (whole coil) (MΩ)	<1.6MΩ	<1.6MΩ
Nominal Weight/metre (g/m)	330 – 370g/m	210 – 230g/m

Explosive Delivery Systems



As a Dyno Nobel customer, you benefit from the DynoMiner™ range of state-of-the-art bulk emulsion, explosive delivery systems for metalliferous mining. They are the latest technological advancements that increase safety and productivity and reduce costs.

Development

A choice of two emulsion explosive delivery systems is available for development headings. Compared with traditional methods, both systems significantly increase the safety for operators, ease, flexibility and efficiency of loading explosives underground, and reduce your costs. In addition, the equipment is operated by you, the customer.

The DynoMiner™ Advance (top right) is a basic, compact, air operated unit. It is offered as a cage unit which is mounted onto the customer's standard IT carrier. Two operators are required to operate the DynoMiner Advance. It can also be supplied as a shaft sinking variant.

The DynoMiner™ Profile (middle right) offers greater flexibility, precision and capacity. It is ideal for the control of perimeter blasting through its cutting edge string loading capabilities. The hydraulically driven unit is fully integrated onto the customer's mine carrier and is operated by a single operator.



Production

The DynoMiner™ Uphole (bottom right) comprises a purpose-built truck designed for the demanding conditions of underground production mining. It is a fully integrated vehicle that loads accurately and has a multiple density capability – important features for controlling back break. It is operated by a single operator, and can be used in both uphole and downhole applications.



ING WITHIN 10 M

FM9

DYNO
Dyno Nobel

7145



Reference

Conversion table

This unit	▶	Multiplied by	▶	Converts to	This unit	▶	Multiplied by	▶	Converts to
Length					Density				
metres (m)		3.280		feet (ft)	lbs / ft ³		16.02		kg / m ³
		39.370		inches (in)	gm / cm ³		62.43		lb / ft ³
inches (in)		25.400		millimetres (mm)	Powder Factor				
kilometres (km)		0.621		miles	kg / m ³		1.69		lb / yd ³
Mass					Speed				
kilogram (kg)		2.20		lb	m / sec		3.28		ft / sec
metric tonne (t)		1.10		short tons	in / sec		25.4		mm / sec
ounce Avoirdupois (oz)		28.35		grams (g)	km / hour		0.62		mile / hour
ounce Troy (oz)		31.10		grams (g)	Pressure				
grains		0.06		grams (g)	psi		6.89		kPa
Energy					atmosphere (Atm)		14.70		psi
joule		0.24		calorie	bar		14.50		psi
		0.74		ft-lb	bar		100		kPa
calorie		3.09		ft-lb	Temperature				
kilowatt		1.34		horsepower	fahrenheit -32		0.56		centigrade
Volume					centigrade +17.78		1.8		fahrenheit
cubic centimetres (cm ³ or cc)		0.06		in ³	Area				
cubic metres (m ³)		1.31		yd ³	cm ²		0.16		in ²
cubic feet (ft ³)		0.03		m ³	m ²		1550.00		in ²
US gallon		3.79		litres (l)	ft ²		0.09		m ²
ounces (US fluid)		29.57		cm ³	Converts to	◀	Divided by	◀	This unit
Converts to	◀	Divided by	◀	This unit	Converts to	◀	Divided by	◀	This unit

Properties of typical rock types

Material	Solid Density (t/m ³)	Unconfined Compressive Strength (MN/m ²)	Young's Modulus (x10 ¹⁰ N/m ²)	Poisson's Ratio
Basalt	3.00	78 – 412	2 – 10	0.14 – 0.25
Bauxite	2.05			
Clay – dense, wet	1.70			
Coal, Anthracite	1.60	8 – 50		
Coal, Bituminous	1.36			
Dolerite	2.80	290 – 500		
Dolomite	2.96	15 – 118	2.0 – 8.4	0.1 – 0.2
Earth, moist	1.80			
Gneiss	2.88	78 – 240	2.5 – 6.0	0.1 – 0.19
Granite	2.72	100 – 275	2.5 – 7.0	0.15 – 0.34
Gypsum	2.80			
Iron ore	4.89			
Limestone	2.64	10 – 245	1 – 8	0.1 – 0.23

Properties of typical rock types continued

Material	Solid Density (t/m ³)	Unconfined Compressive Strength (MN/m ²)	Young's Modulus (x10 ¹⁰ N/m ²)	Poisson's Ratio
Limonite	3.76			
Magnetite	5.05			
Marble	2.48	50 – 200	6.0 – 9.0	0.2 – 0.35
Mica-Schist	2.70			
Porphory	2.56			
Quartzite	2.50	85 – 350	2.6 – 10	0.15 – 0.2
Sandstone	2.40	50 – 160	0.5 – 8.6	0.1 – 0.3
Shale	2.58	20 – 150	0.8 – 3.0	0.1 – 0.3
Silica Sand	2.56			
Siltstone	2.25			
Slate	2.72	98 – 196	3.0 – 9.0	0.1 – .044
Talc	2.64			

Underground blast design

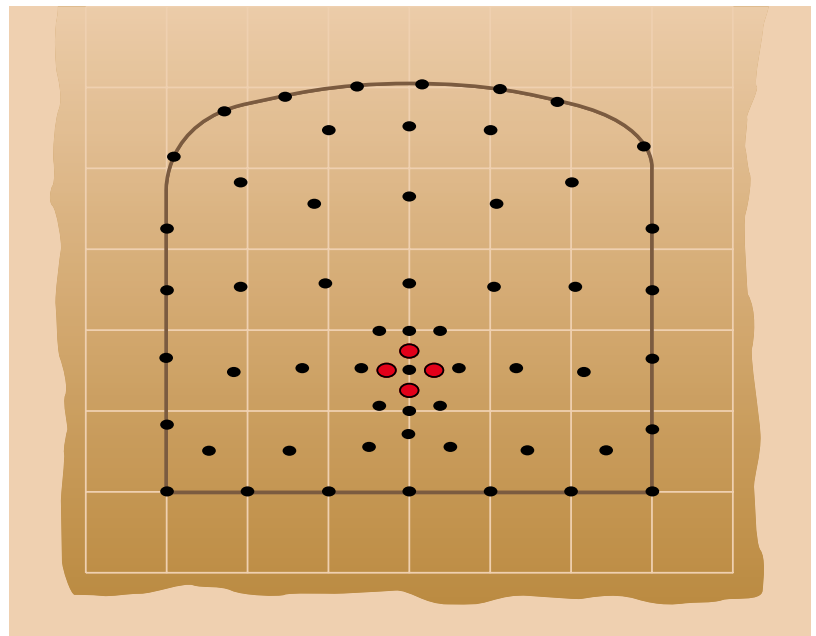
Shoulder hole – These refer to those holes immediately below the back perimeter holes.

Burn cut – The burncut consists of a group of blastholes arranged in a regular pattern around one or more uncharged relief holes. The first firing blasthole breaks both into the void offered by the uncharged relief holes and towards the free face provided by the tunnel face.

Easer – Hole adjacent to cut area.

Lifters – The blastholes along the bottom of the developed round. Proper performance of the lifters are essential in achieving good floor control.

Perimeter blastholes – Perimeter blastholes are those which form the boundary of the tunnel. Explosive loading densities in these blastholes are generally lower than those in the remainder of the blast, as their prime requirement is to minimise back-break and provide a good contour.



Design of cut

The following formulae are used for the geometric design of the cut area:

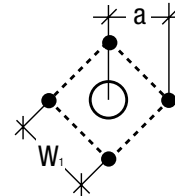
For multiple reamer holes: $\phi = d\sqrt{n}$

Where: d = diameter of empty reamer holes

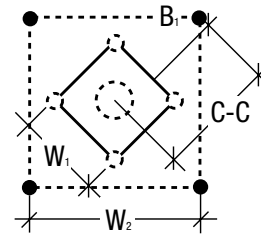
n = number of reamer holes

The cut:

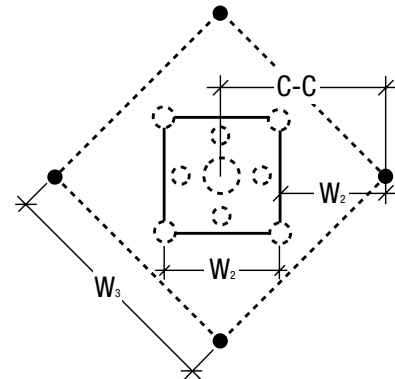
1st square:	$a = 1.5\phi$	ϕ mm =	76	89	102	127	154
	$W_1 = a\sqrt{2}$	a mm =	110	130	150	190	230
		W1 mm =	150	180	210	270	320



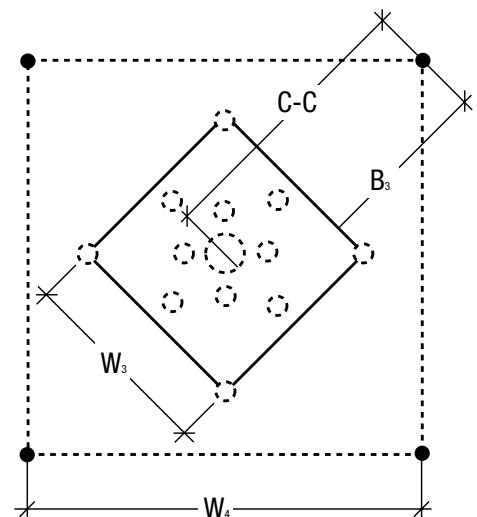
2nd square:	$B_1 = W_1$	ϕ mm =	76	89	102	127	154
	$C-C = 1.5W_1$	W1 =	150	180	210	270	320
	$W_2 = 1.5W_1\sqrt{2}$	C-C =	225	270	310	400	480
		W2 mm =	320	380	440	560	670



3rd square:	$B_2 = W_2$	ϕ mm =	76	89	102	127	154
	$C-C = 1.5W_2$	W2 mm =	320	380	440	560	670
	$W_3 = 1.5W_2\sqrt{2}$	C-C =	480	570	660	840	1000
		W3 mm =	670	800	930	1180	1400



4th square:	$B_3 = W_3$	ϕ mm =	76	89	102	127
	$C-C = 1.5W_3$	W3 mm =	670	800	930	1180
	$W_4 = 1.5W_3\sqrt{2}$	C-C =	1000	1200	1400	1750
		W4 mm =	1400	1700	1980	2400



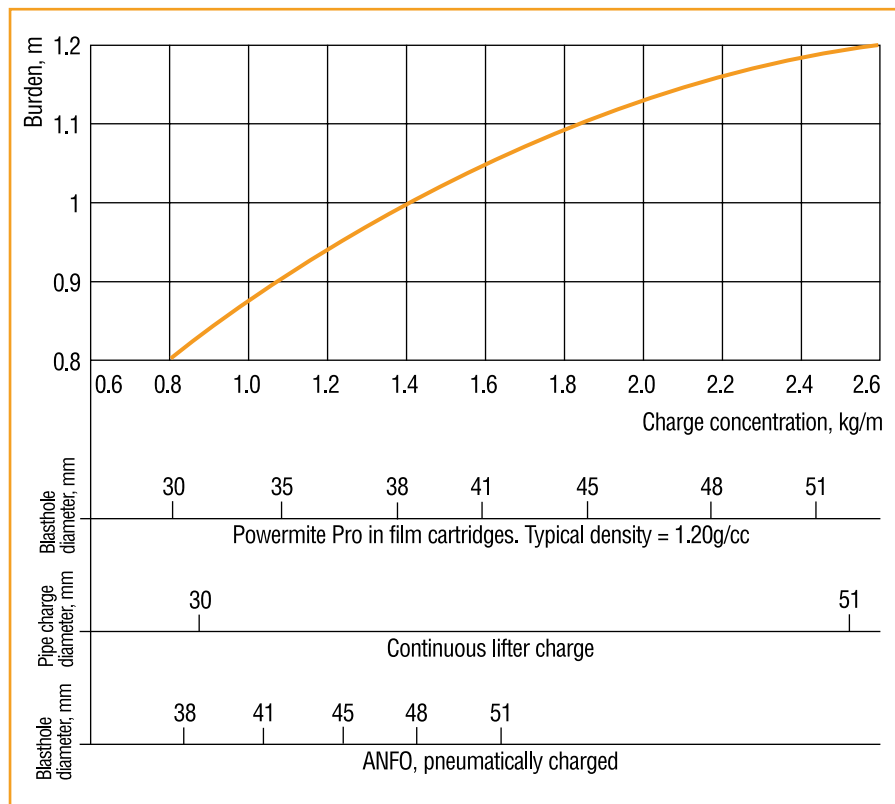
Design of lifter & easer holes

When the cut holes have been calculated, the rest of the development round may be calculated.

The round is divided into:

- lifter holes
- side holes
- back holes
- easer holes with breakage upwards and horizontally
- easer holes with breakage downwards

To calculate burdens (B) and charges for the different parts of the round the following graph may be used as a basis.



Safe handling, transportation and storage

First Aid

Detailed first aid information regarding our products is contained on the relevant Dyno Nobel Material Safety Data Sheets.

Safety

All explosives are classified as dangerous goods and can cause personal injury and damage to property if used incorrectly.

Transportation and Storage

All explosives must be handled, transported and stored in accordance with all relevant regulations. Stock should be rotated so that older products are used first.

Technical Information

You can find technical information on www.dynonobel.com or speak to your Dyno Nobel Business Manager.

We offer a comprehensive range of:

- Technical Data Sheets (TDS)
- Material Safety Data Sheets (MSDS)
- Blasting and Explosives Quick Reference Guide
- Computer-Based Training (CBT) CDs
- Field Training Manuals
- Product Price Lists

Glossary

Airblast Airborne shock wave resulting from the detonation of explosives.

Back break Rock broken beyond the limits of the last row.

Borehole pressure The pressure which the gasses of detonation exert on the borehole wall.

Charge weight The amount of explosive charge in kilograms.

Column charge A continuous charge of explosives in a borehole.

Critical diameter The minimum diameter for propagation of a stable detonation.

Cutoffs A portion of an explosive column that has failed to detonate due to rock movement.

Decoupling The use of explosive products having smaller volume than the volume of the blasthole it occupies.

Delay blasting The use of delay detonators or connectors to separate charges by a defined time.

Density Mass per unit volume.

Detonation pressure The pressure created in the reaction zone of a detonating explosive.

Explosive Any chemical or mixture of chemicals that can react to produce an explosion.

Free face A rock surface that provides the rock with room to expand when blasted.

Flyrock Rock that is propelled through air from a blast.

Fragmentation Measure to describe the size of distribution of broken rock after blasting.

Ground vibration Ground movement caused by the stress waves emanating from a blast.

Initiation The act of detonating explosives by any means.

Line drilling A method of overbreak control which uses a series of closely spaced holes that are not charged.

Loading density The weight of explosives per metre of borehole.

Maximum Instantaneous Charge (MIC) Mass of explosive detonating in some defined time period, usually 8 milliseconds.

Overbreak Excessive breakage of rock beyond the desired excavation limit.

Particle velocity The speed of movement in a given direction of a rock or soil mass.

Pre-split A controlled blast in which decoupled charges are fired in holes on the perimeter of the excavation prior to the main firing.

Relative Bulk Strength (RBS) The energy yield per unit volume of an explosive compared to ANFO.

Relative Weight Strength (RWS) The energy yield per unit mass of an explosive compared to ANFO.

Spacing The distance between boreholes in the same row.

Stemming Inert material used to confine the gasses generated during detonation.

Swell factor The ratio of the volume of broken rock to the volume of in-situ rock.

Velocity of Detonation (VOD) The velocity at which a detonation progresses through an explosive.



DISCLAIMER

The information and suggestions contained in this document concern explosive products that should only be dealt with by persons having the appropriate technical skills, training and licence. The results obtained from the use of such products depend to a large degree on the conditions under which the products are stored, transported and used.

While Dyno Nobel makes every effort to ensure the details contained in the document are as accurate as possible, the conditions under which the products are used are not within its control. Each user is responsible for being aware of the details in the document and the product applications in the specific context of the intended use. If technical advice is required in the specific application of the products then you should contact Dyno Nobel for assistance.

To the full extent permitted by law, Dyno Nobel makes no warranties in relation to the products it sells and bears no risk, responsibility or liability arising from the use of the products and the information in this document by the buyer or user of the products.

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Dyno Nobel Asia Pacific Pty Limited (ACN 003 269 010) is a subsidiary of Incitec Pivot Limited (ACN 004 080 264).

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DYNO
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Groundbreaking Performance