



## Raydet

### Non-Electric Blast Initiation System

The Explosives Division of Gulf Oil Corporation Limited manufactures the full range of shocktube based non-electric delay detonators under the brand name **Raydet**.

**Raydet** consists of a hollow polymer tube of desired length containing a very small quantity of reactive material in its annular space. The detonation (shock wave) is contained within the tube and hence it is non-disruptive. This tube is generically known as shock tube or signal tube and is the important component of the system.

A No.8 strength Millisecond (MS) or Half Second (HS) delay detonator is factory-assembled to one end of the tube. The other end is sealed to prevent ingress of moisture and other extraneous material. Commensurate to field application, a plastic connector is provided at the free end of the tube or on the detonator shell for hook-up. The detonator is a conventional one having desired dosage of Penta Erythritol Tetra Nitrate (PETN) as base charge and mixture of Lead Azide, Lead Styphnate and Aluminum powder (ASA mixture) as priming charge. A pyrotechnic delay element placed above the ASA provides the delay. ASA mixture is sensitive to flame and PETN is sensitive to the shock generated by ASA. On detonation, the shock tube initiates the delay element. The flame conveyed by the delay element initiates the ASA mixture, which in turn, sets off the PETN.

The shock tube is initiated with a detonator, detonating cord, percussion cap or an electronic spark-producing device. Upon initiation, a low order shock wave with a velocity of detonation, approximately 2000 m/sec travels inside the tube and reliably initiates the delay detonator crimped at its end.

Raydet can be used in a number of surface and below ground blasting applications such as bench blasting, trench blasting, quarrying, tunneling, large hole stoping, ring blasting etc in mining, civil construction and underwater blasting. Raydet MS (Millisecond), HS (Half Second), LP (Long Period), DTH (Down-The-Hole), TLD (Trunk Line Delay) and Twindet are the variants available for use in the different applications described above.

Raydet is supplied in coil form and a gummed paper tape indicating the tube length holds the coil in position. Stickers indicate the product type and delay number or delay interval. Raydet is available in different tube lengths to suit user's requirements and can be supplied with tube length of 2 m to 75 m.

## Advantages of Raydet System

Being a non-electric system, Raydet is immune to extraneous electricity sources such as stray currents, static electricity charges and radio frequency (RF) energies emanating from walkie-talkies. It also eliminates the risk of misfire of electric detonator due to current leakage through damaged lead wires in highly conductive ore bodies and watery drillholes.

Tube is non-disruptive as the detonation is contained within it, unlike detonating cord, which generates brisance. Raydet does not cause de-sensitization of booster-sensitive explosive leading to higher explosive energy release. Raydet does not cause ejection of stemming from the drillhole and prevents premature venting of explosive energy. Raydet initiates the explosive at a single point in the drillhole and detonation travels along the explosive column.

Raydet assists in achieving 'true bottom hole initiation', the desired method in bench blasting. This reduces flyrock generation and formation of 'toe' on the bench floor. With detonating cord downline, the detonation moves from top to bottom encouraging cratering, the main cause of flyrock and airblast noise.

Combination of Raydet in-hole and surface delays facilitate generating multiple sequential delays, which results in better fragmentation. This reduces maximum charge per delay and thus peak particle velocity (PPV). When used on the surface in place of detonating cord trunklines, Raydet significantly reduces airblast noise.

Explosive decks in the same drillhole can be initiated on different delay intervals to reduce maximum charge per delay. This is very useful while carrying out cautious surface blasting in the vicinity of dwellings and while blasting multiple explosive decks in largehole stoping and pillar blasting operations in underground metal mines.

### Raydet MS, Raydet HS & Raydet LP Series

Raydet Millisecond (MS), Half Second (HS) and Long Period (LP) – these are non-electric delay detonators consisting of a desired length shock tube. No.8 strength delay detonator of appropriate delay is factory assembled to one end of the tube. The other end is sealed to prevent ingress of moisture. A plastic connector is provided at the free end of the tube for hooking up the tube to detonating cord of 6 to 10 g/m.

Raydet millisecond (20 delay periods), half second (12 delay periods) and LP series (16 delay periods) are available. The nominal delay intervals are:

Delay No.	Millisecond (Short Delay)	Half Second (Long Delay)	LP Series
00	--	--	50
01	50 ms	0.5 second	175
02	75 ms	1.0 second	325
03	100 ms	1.5 seconds	475
04	125 ms	2.0 seconds	775
05	150 ms	2.5 seconds	1100
06	175 ms	3.0 seconds	1500
07	225 ms	3.5 seconds	2000
08	275 ms	4.0 seconds	2500
09	325 ms	4.5 seconds	3000
10	375 ms	5.0 seconds	3500
11	425 ms	5.5 seconds	4000
12	475 ms	6.0 seconds	4500
13	550 ms	--	5000
14	625 ms	--	5500
15	700 ms	--	6000
16	775 ms	--	--
17	850 ms	--	--
18	925 ms	--	--
19	1000 ms	--	--
20	1100 ms	--	--

These Raydet delays can be used in:

- Tunneling and shaft sinking
- Ring blasting
- Drop raising and large hole stoping
- Surface blasting, quarrying and trenching
- Civil and infrastructure works
- Underwater blasting

In tunnels of large cross sections, combination of millisecond and half-second delays are used to achieve a large number of delay periods. Millisecond delays are used in the 'cut' portion to create the initial free face and half second delays in the remaining portions.

In tunneling operations, 'bunch blasting' of 12-15 tubes with a single wrap of 10 grams/meter detonating cord or connecting the tubes to the detonating cord trunkline using the plastic connectors, offers means of easy and fast hook-up.

## Raydet DTH (Down-The-Hole)

Raydet DTH (Down-The-Hole) is essentially a millisecond Raydet delay detonator with accurate firing times of 200, 250, 450, 475 and 500 ms. Raydet DTH is used to initiate cap-sensitive explosive in the drillhole. A plastic connector suitable for hook-up with detonating cord is provided at the sealed end of the tube of the Raydet DTH. Tube of the Raydet DTH is initiated at the collar with detonating cord trunkline or Raydet TLD.

Using a high delay interval of 475 milliseconds ensures that the detonation of the surface hook-up would be several rows or drillholes ahead before the first drillhole gets initiated (after 475 ms) and ground movement starts subsequently. This greatly reduces the risk of misfires due to cut-off of initiation system by the ground movement.

Use of Raydet DTH 475 (475 ms) at the drillhole bottom and Raydet DTH 500 (500 ms) with a shorter tube length near the collar enables the blasting engineer to provide a back up insurance to ensure misfire-free blasts. This system also enables firing two (or more) explosive decks in the same drillhole on different delays thus reducing the maximum charge per delay. This helps in controlling ground vibrations while carrying out cautious blasting operations near dwellings. Raydet DTH can be used in bench blasting, quarrying and trench blasting. In underground metal mines, it is suitable for large hole stoping and drop raising applications.

### Raydet TLD (Trunk Line Delay)

Raydet TLD is a mono-directional surface millisecond delay initiation system. A low strength Raydet millisecond delay detonator is placed inside a specially designed plastic bunch connector and anchored to it. The bunch connector is designed for connecting 6 Raydet tubes. The outgoing Raydets from a TLD can be DTH units leading into the drillhole and TLD units placed in the surface blast hook-up for generating non-electric sequential blasting.

Use of Raydet TLD on the surface hook-up in place of detonating cord significantly reduces airblast noise in view of the non-disruptive nature of tube.

TLD units are supplied in various tube lengths commensurate to need and available in delay intervals of 0, 17, 25, 42, 50, 67, 109 & 176 milliseconds. Instantaneous Raydet TLD units can be used in tunneling for bunch blasting of Raydet detonators in place of detonating cord.

### Raydet Twindet

Raydet Twindet is a two-in-one system having a DTH at one end of the shock tube and a TLD at the other end.

## Contact Information

For more information, please contact:



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Features and specifications mentioned in this brochure are subject to change due to continuous improvements through research and development.

## Packaging

All Raydet products are packed in coil form and placed in polythene bags. A printed label placed inside gives details of product, date of manufacture and other details. The polythene bags containing Raydets are placed inside a corrugated fiberboard case. Markings on the case indicate manufacturer's name, product name, tube length, delay number / delay interval, case number, date of manufacture, net weight and gross weight. Quantity packed in a case is as under:

Tube Length (m)	Quantity (nos.)
2, 3	400
4, 5	300
6 to 10	200
11 to 20	100
21 to 35	50
36 to 45	25

## Precautions while using Raydet

- Factory sealed end of Raydet tube should not be cut.
- Two Raydet tubes should NOT be connected or knotted for initiating one another. Unlike detonating cord, one tube will NOT initiate another through knots.
- Kink should NOT be formed on the tube during charging operations. If a kink occurs, it should be unfurled and charging resumed. If the tube appears to be damaged, the drillhole or the deck should be re-primed with another Raydet.
- Charging of drillholes should be carried out carefully. Tube should not be subjected to damage such as abrasion during charging and stemming, walking over it with boots, driving vehicle over the tube. Tube can snap due to sudden jerk while loading.
- Raydet should not be kept charged along with explosives in the drillhole for a long time (sleeping charge). Kindly contact manufacturer for details.

- Detonators have an identification mark on the shell bottom



## Precautions

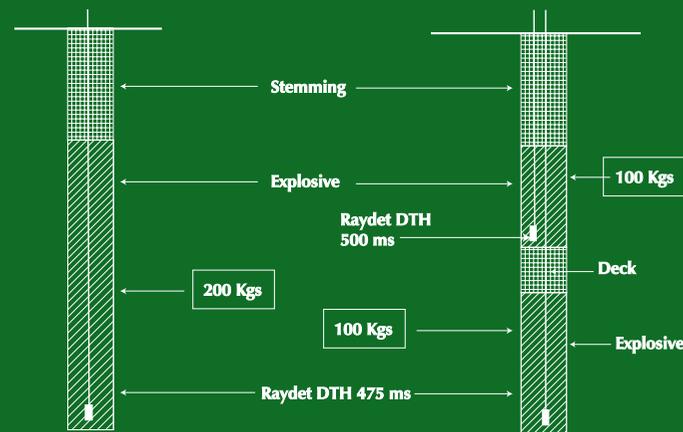
- Do NOT subject detonators to impact, friction and fire.
- NEVER force a detonator into explosive cartridge. Always use pricker made of non-sparking material to pierce the wrapper while priming.
- Connect detonator to the hook-up just prior to firing the blast.
- Always keep the ends of blasting cable shorted and unhook just prior to connections. Disconnect the blasting cable from the exploder if circuit needs to be checked.
- Do NOT carry out explosives charging during an approaching storm and lightning activity in the blast area. Vacate the blast area and resume operations only after the storm has passed.
- Do NOT attempt to fight explosive fires.

 CE (Conformité Européenne) Mark is approved for the following Raydet products:

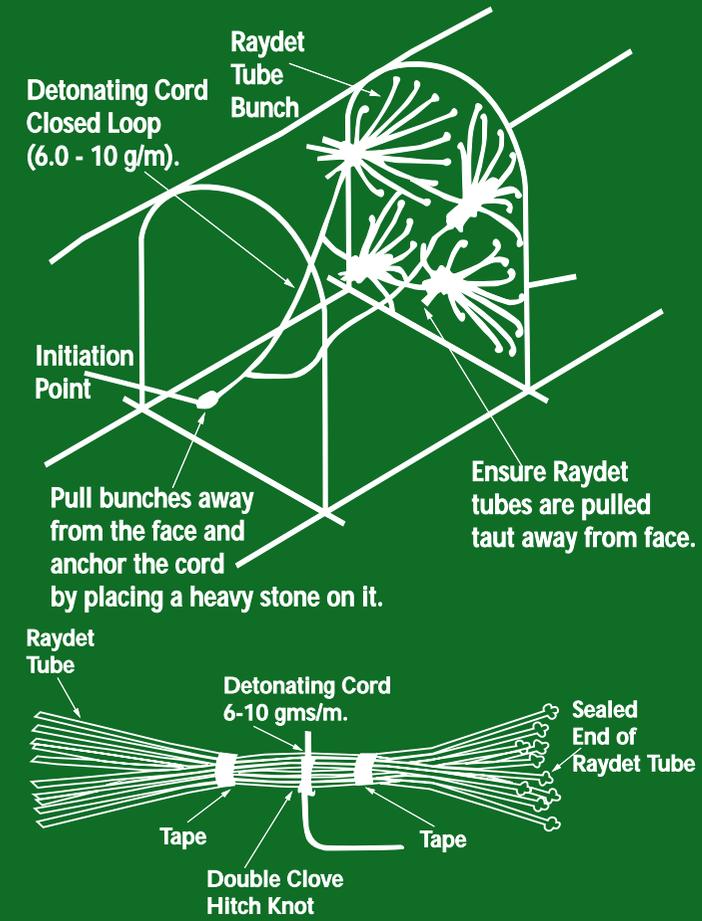
- Raydet Millisecond
- Raydet DTH
- Raydet TLD

## Statutory Classifications

<b>Petroleum &amp; Explosives Safety Organization (PESO), Government of India</b>	Class 6 Division 3
<b>IMDG Classification:</b>	
Class	1
Division	1.1
Group	B
U.N Number	0360
Page Number	1256
Stowage Category	II Type 'C'



## Bunch Blasting of Raydet Using Detonating Cord



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