Dynasafe Mobile SDC 1200M Munitions Detonation Chamber

The field proven Dynasafe SDC1200 Static Detonation Chamber is a novel and innovative mobile detonation chamber which can handle large explosive items. The SDC system is a mobile, totally enclosed, gas tight system used for the destruction of munitions which are either explosively or non-explosively configured. The system does not require the use of explosive counter charges to destroy munitions. This lowers costs and logistic burdens and reduces the risk of accidental explosions and unexpected environmental release.

The system is very flexible, and is able to process many sizes of munitions, and can also decontaminate equipment, scrap or soil. The unit is able to handle bulk high explosives, propellants, projectiles (up to 81mm mortars fed without any preparation, larger sizes can be fed if cut first), mines (AP and AT), small arms, CAD/PADs and rockets. If a round contains smokes, illumination mixtures, WP or a fuze, these are destroyed at the same time that the explosive is destroyed, again without the need for countercharges, and with an absolute minimum of munitions handling. Scrap exiting the process is treated to true 5X conditions for explosives, having been exposed to over 1000 degrees F for at least 30 minutes. The unit is designed and built in such a way as to eliminate worker or public exposure to explosive or environmental hazards at any time during operations, and to produce products that are not only environmentally acceptable but are able to be recycled without further processing.

The SDC 1200 unit is a fully operational piece of automated process equipment which has been designed with safety and high rate demil production in mind. The system is designed with interlocks and redundant systems where required, for safety and to prevent release of untreated products. A gas treatment system meeting EPA requirements is included. Most munitions are processed without cutting, disassembly or any other additional processing, and mixed munitions can be processed at the same time to maximize production rates. There are some munitions that do require prior processing, these are munitions containing shaped charges, and munitions which contain more than 1200 grams (2.6 pounds) of explosive (Net Explosive weight (NEW) TNT equivalent). For these munitions, some processing or cutting is required to either defeat the shaped charge or reduce the amount of explosives per item to less than 2.6 lb. This can be accomplished by a water jet or other cutting system. Items to be destroyed can be fuzed or unfuzed, and unstable propellant, unknown items, bulk propellant, bulk explosives, plastics, aluminum, contaminated trash and other materials can be accommodated. UXO, DUDS, and MD present no problems, and it is not necessary to determine the explosive fill before processing if the fill is unknown.

Unlike an incinerator, there is no open flame or external fuel source used in the process. The SDC is powered with clean electrical heating elements, and is insulated to retain heat. Power and other utility requirements are minimized, as the only time electricity is used to heat the unit is at initial startup and at standby. During operations, heat from the explosives or propellants being destroyed supplies the necessary heat to keep the unit at temperature. There are no wastewater disposal requirements from the gas treatment system as the system produces none. Labor requirements are also low, typically three persons per shift, two loaders and one in the control room. Q/D requirements are low, consisting of only the distance required for one shift's worth of munitions. Figure 1 provides a view of the SDC 1200 mobile unit.

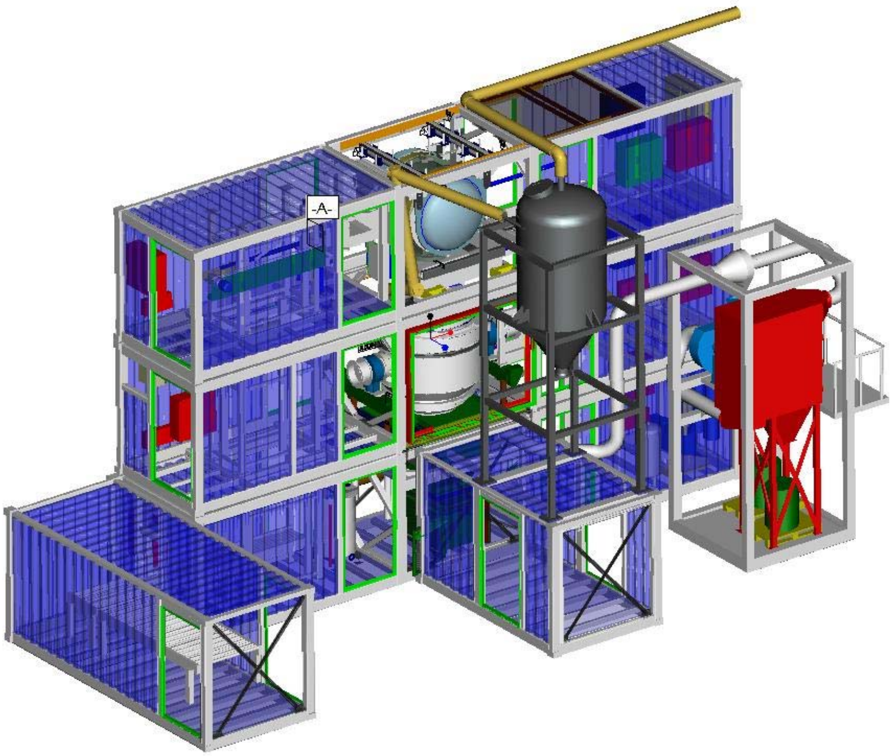

Figure 1 SDC 1200 Mobile Unit

Using such a system for demilitarization has a lot of advantages. In addition to obsolete and unusable munitions, bulk explosives, small lots, R&D explosives, propellants, aging samples, incomplete and disassembled items, unknown explosives, CEA and sectioned pieces of munitions can all be accommodated without problems. Classified items can be demilitarized and the metal pieces recovered to ensure security. Following is a detailed description of the SDC 1200 components.

Destruction Chamber and Enclosure - The SDC1200 is essentially a heated, armored, double shell retort, which is kept at a temperature of 550 to 600 degrees Centigrade (1022 to 1112 degrees F). A cross section through the chamber and overall unit is shown as Figure 2 - SDC 1200 cross section through the chamber

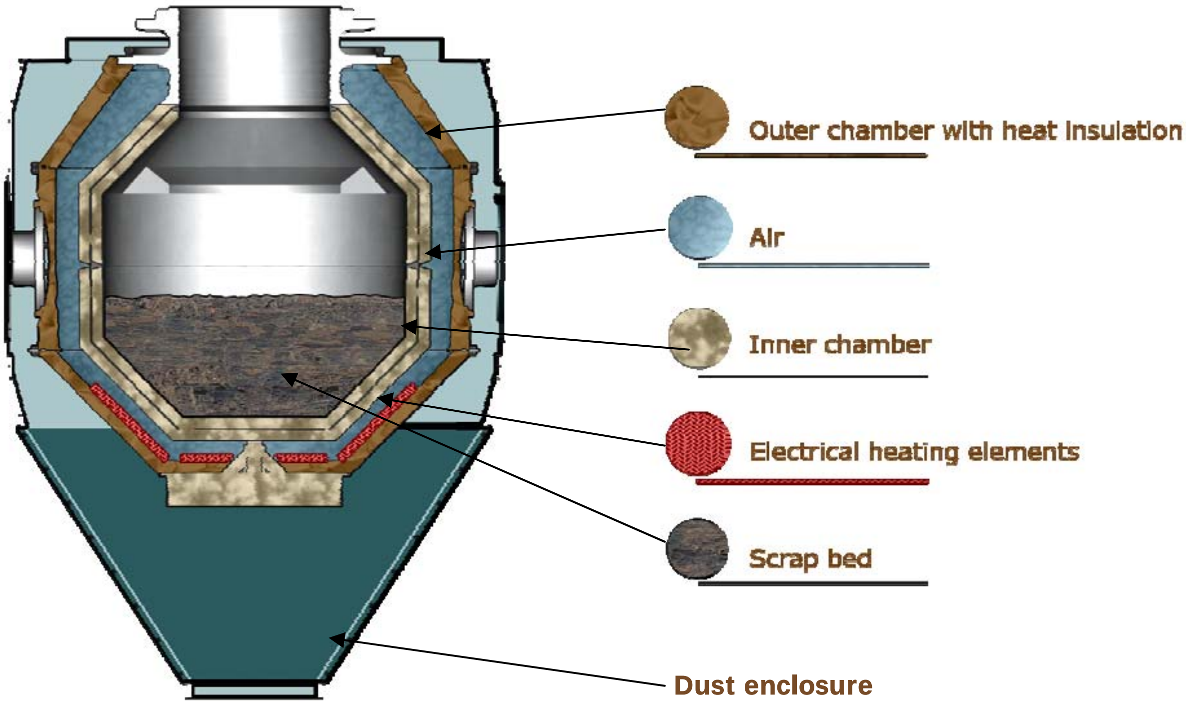

Figure 2 - SDC 1200 cross section through the chamber

The inner chamber is manufactured from a heat resistant stainless steel with excellent tensile properties at high temperatures. The wall thickness is much greater than required by the mechanical stress loads caused by detonation pressures. The inner chamber is designed for a maximum detonation of 1.0kg of TNT plus a 100% margin. The chamber thickness is 7 cm of stainless steel based on 100,000 hours stress to rupture plus an additional 7 cm of Stainless steel as a safety factor. The extra wall thickness also serves as a wear layer to protect the chamber from fragments that may occur during the destruction process. In actual use, the inner layer of the inner chamber has shown negligible wear even after treating over 6,000,000 pounds of munitions, so that longevity of the equipment is not an issue. The inner chamber is field replaceable if necessary. The inner chamber is surrounded by and sealed to an additional chamber made of the same steel as the inner one that serves as a 100% backup for the inner chamber. The inner and outer chambers are separated from one another by an air space which serves to decouple detonation stresses from the inner to the outer chamber, thus enhancing the overall safety and reliability of the unit. Also placed within this air space are electric resistance heaters, which supply heat to the unit. The outer chamber also includes thermal insulation on the outside for efficiency. Both the inner and outer chambers are housed in a dust enclosure which is kept under negative pressure. This enclosure serves as an additional barrier and protects workers from burns and dust, as well as providing additional containment in the highly unlikely event that both the inner and outer chambers are breached.

Automated Feeding System - During operations the inner chamber is mated to a flange which is attached to the feeding system. The connection uses metal gaskets backed up with triple redundant inflatable seal rings to ensure a leak tight seal.

The feeding system is composed of a feed conveyer and two airlock type feeding chambers equipped with doors. All munition items or explosives are fed in disposable cardboard boxes which prevent the items from rolling and/or misfeeding. All movements from the feed conveyer to the first loading chamber are automatic; however the control room operator has full control of all movements and can abort or reverse the movements as required. The feed conveyer is also equipped with guides, interlocks and sensors that prevent items falling off the conveyer or other problems, and will halt movements automatically if problems arise.

Once at the apron of the first feed chamber and the operator gives the go-ahead for the loading operation, the first feed chamber door is opened to admit the box containing the munition item(s). The first loading chamber door is equipped with an inflatable gasket seal which prevents leakage from the first loading chamber out into the environment, and an additional inflatable seal on a second door which isolates the first loading chamber from the second loading chamber when the first one is open to receive feed items. After the first door is opened, the box containing the munition item(s) is automatically placed into the first loading chamber which is equipped with sensors to detect misfeeds and other problems. After the box is in the first feed chamber, the first loading door is closed and sealed.

At this time the first loading chamber is pressurized with a low pressure air feed so that the first loading chamber is at a positive pressure with respect to the second loading chamber. Next the second loading door, is unsealed and opened. The munition item(s) are placed into the second loading chamber. The second door is then closed and sealed. During the loading operation pressurized air sweeps through the first chamber and into the second so that the first chamber remains clear of any contamination. Sweep air leaving the second loading chamber is conveyed through piping and valves to the SDC main chamber. In this way the second loading chamber is kept at a low positive pressure with respect to the SDC main chamber. Next the fragment shield is opened. The function of the fragment shield is not only to reduce contamination of the second loading chamber, but also to block heat from the destruction chamber (inner destruction chamber) from entering. The fragment shield is a round circular plug shaped device that is lowered into the upper tubular part of the inner chamber during operations to prevent fragments from impacting the second loading chamber. When opened, the plug is hydraulically lifted to open a path to the second feed chamber. One feature of the feeding chambers and doors is that they are configured and designed to contain detonations or fragments within them equal to the design limit of the rest of the chamber. After the fragment shield is opened, the floor of the second loading chamber tilts up and the box containing the round falls into the main (heated) detonation chamber.

After the munitions items are fed into the inner detonation chamber the items heat up and the explosives cook off, usually resulting in a detonation or deflagration. All gasses, fragments and noise are contained within the unit. As there is insufficient air contained within the detonation chamber to support combustion of the detonation products and agents, the result is a pyrolysis reaction, which breaks down the detonation gasses to simple, non-toxic compounds. The detonation chamber is equipped with valves in the air inlet and exhaust lines which can be shut to isolate the chamber to hold the gasses evolved for additional treatment or in the event of a malfunction in the Pollution Abatement System (PAS) as an integrated safety interlock.

If the item is not explosively configured, the fill will pressurize the container (shell) until the container fails. The container failure will occur at a weak point in the container, usually at the burster well crimp to the body of the projectile, or the fuze well on grenades.

Gas Treatment System - The gasses resulting from the pyrolysis treatment are directed through a gas treatment system or PAS. The gasses are conveyed first to an equalization tank which serves to reduce the pulsation effects of the detonations and allows for more efficient gas processing in the PAS. From the equalization tank the gasses pass through a cyclone to remove particulates if any (particulates removed are periodically recycled to the system) and then to an oxidizer to react the reduced pyrolysis gasses to carbon dioxide and water. This is followed by a fast quench system to minimize the formation of dioxins and furans. The gasses next are conveyed to a dry scrubber to remove pollutants. Next he gasses pass through a DENOX system to reduce NOx. The amount of gas requiring treatment is actually quite low, as there are no combustion gasses from any burners in this system.

Scrap handing - Scrap materials remaining in the detonation chamber are held at the chamber temperature, (1100 F for at least 30 minutes) which ensures complete decontamination. When the chamber becomes 50% filled up with metal scrap from the demilitarization process (2 to 5 tons of scrap, or once a week at a minimum) the feed is stopped and a 1/2 hour waiting period commences. This waiting period assures that:

- All energetic materials within the scrap pile have reacted and been destroyed and
- Residual contamination (if any) on the last item processed is destroyed.

After the waiting period, the inner/outer chamber is unmated from the feed system, the chamber is inverted and the scrap is dumped out into scrap bins located under the chamber. A small amount of scrap is retained within the unit to serve as a bed for the next feeding cycle. The scrap unloading operation is automatic, but under operator control and is performed remotely. All removed scrap and dust is retained within the third (outer) dust enclosure (figure 1), which is kept under a negative pressure with respect to the outside environment.

The scrap bin enclosure serves as a location for the scrap to cool to a temperature safe to handle. During the scrap holding and cool down period the chamber is re-mated to the feeding system flange and resumes destruction operations. After the scrap has cooled, the scrap bin doors are opened and the scrap bin is removed, and then replaced with an empty bin. The scrap is then inspected to ensure that all items have opened. If there is any doubt, the item is weighed. If there is still any doubt, the item is reprocessed. After inspection is passed the scrap is ready for recycle (it having been exposed to over 1000 degrees F for more than 30 minutes, and in most cases the scrap has seen that temperature for several hours).

Power and other utility requirements are low, as the only time electricity is used to heat the unit is at initial startup and at standby. During operations, heat from the explosives or propellants being destroyed supplies the necessary heat to keep the unit at temperature. There are no wastewater disposal requirements from the gas treatment system.

Production Rates - Actual production rates that have been achieved using an SDC 1200 unit for conventional munitions are presented in Table 1. In the table direct feed refers to munitions fed directly to the unit without preparation, while cut/feed refers to items cut before feeding to either reduce the amount of explosive per item to less than 1.2 kg NEW TNT or equivalent or to defeat shaped charges in the items that contained them.

Table 1: Actual Production Rates

Item No.	Description	Quantity Destroyed	Demil Process	Shifts Required	Calculated Plant Capacity (Units/Shift)
1	Cap Percussion	74,175	Direct Feed	0.1	741,750
2	Booster Cup	26,900	Direct Feed	2.7	9,963
3	Detonator	16, 415	Direct Feed	2.1	7,817
4	Cartg, 20 mm HE	54, 496	Direct Feed	7.0	7,785
5	Cartg, 30 mm HE	30,005	Direct Feed	5.5	5,455
6	30 mm HE	7,154	Direct Feed	1.8	3,974
7	Det Cord (Meters)	200	Direct Feed	0.1	2,000
8	Cartg, 40 mm HE	19,809	Direct Feed	10.0	1,981
9	Electric Fuze	180	Direct Feed	0.1	1,800
10	Mine, M-3 (A/P)	2,316	Direct Feed	1.5	1,544
11	Hand Grenade, MK-2	3,952	Direct Feed	3.0	1,317
12	Mine, M-14	2,731	Direct Feed	3.5	780
13	Flare Trip Wire	1,200	Direct Feed	2.5	480
14	Mortar, 60 mm HE	1,995	Direct Feed	4.5	443
15	Cartg, 57mm Recoilless	4,795	Direct Feed	11.8	406
16	Cartg, 75mm Recoilless	32,149	Direct Feed	95.0	338
17	Cartg, 105mm HE	5,647	Cut/Feed	18.5	305
18	Mortar, 81 mm HE	293	Direct Feed	1.0	293

Worldwide SDC Installations - The SDC series of heated confined detonation chambers have been in use worldwide since 1997. There are four sizes, the SDC 400, 800, 1200, and the largest, the SDC 2000. Since 1997, over nine units of varying sizes have been deployed, some for use in chemical munition destruction operations and some for conventional munitions. All units meet or exceed permit requirements in their respective countries. There have been no explosive mishaps or accidents. UXB owns two units, an SDC 1200 and an SDC 2000, both configured for conventional munitions destruction. The UXB units have been in continuous use since 2003. The table below lists the installations of the SDC unit worldwide to date.

- ***Bofors LIAB AB, Sweden*** - SDC400, delivered in 1997 for destruction of detonators for anti personal mines.
- ***FAEX, Spain*** - SDC1200, delivered in 1997 used for destruction of large amounts of different munitions
- ***Swedish Defense Material Administration, FMV, Sweden*** - SDC800, delivered in January 1999.
- ***Sumitomo Corporation Europe Plc, UK for Hokkaido NOF Corporation, Japan*** - SDC1200, was delivered in May, 2000.
- ***Technip/Germany - IDD/Portugal*** - SDC1200, delivered in November, 2000.
- ***NKK/Japan*** - SDC1200, for project "Destruction of abandoned chemical weapons".
- ***UXB International, USA*** - SDC1200 for destruction of munitions, 2002
- ***UXB International, USA*** - SDC2000 is in operation for all type of munitions, 2003.
- ***GEKA Munster, Germany*** - SDC2000 for the destruction of RCWM chemical munitions, 2005.

Fixed version of the SDC 1200 deployed worldwide

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