4.15 ROTARY METAL PARTS TREATMENT

Reference PFD: AAC-01-F-070 Rotary Metal Parts Treatment

The purpose of the rotary metal parts treatment (RMPT) is to decontaminate the empty projectile and mortar shells by heating the shells to 1,000°F and holding them for a minimum of 15 minutes at that temperature. (Refer to Figure 4-13.)

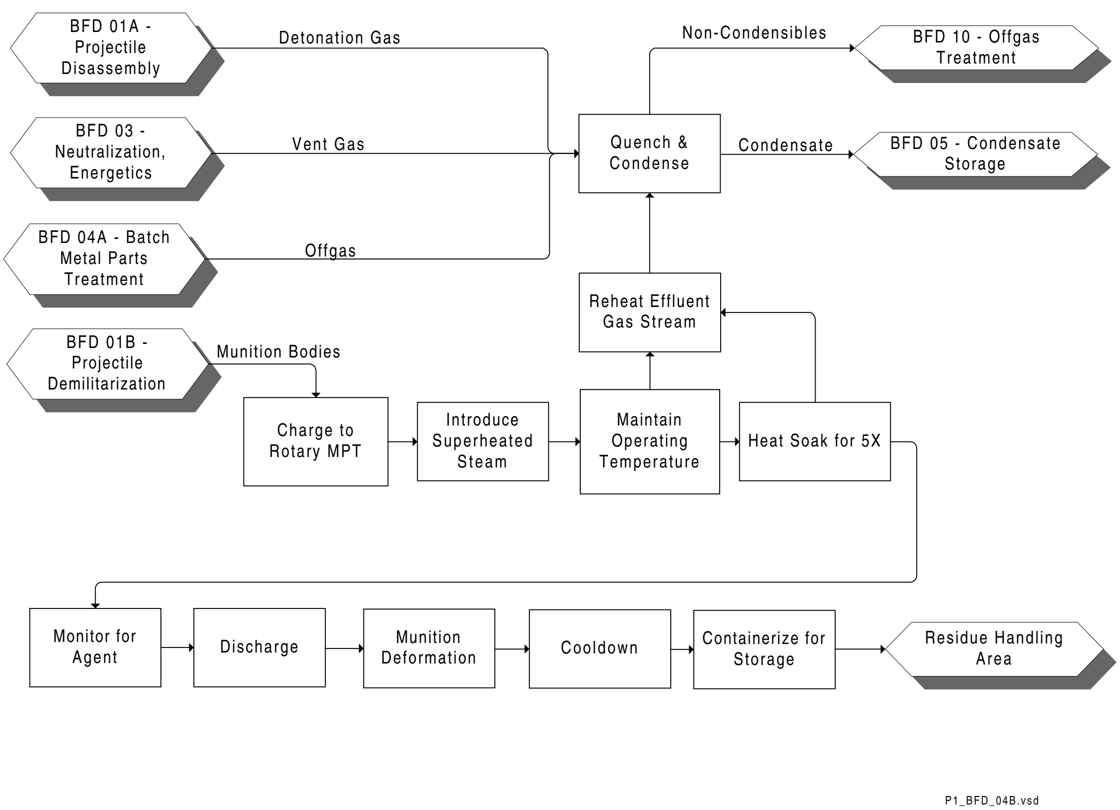


Figure 4-13—Rotary Metal Parts Treatment

The drained and washed munitions from projectile washout are transported by a conveyor system and loaded into the RMPT on a unit feed basis.

The RMPT is heated by using electric induction coils and swept with superheated steam. There will be a vent gas reheater downstream of the RMPT where agent destruction is completed by increasing the temperature of the vent gas to 1,250°F and reforming the agent residual with the steam already present in the vent gas.

Downstream of the reheater, the vent stream, mixed with the vents from the BMPT, ERD and ENRs, will be cooled and condensed, in a quench condenser in contact with a recirculated alkaline brine stream. A purge stream, from the recirculating brine, will be sent to the MPT/CST condensate holding tanks, and from there if agent free to bioreaction via the agent hydrolysate holding tank. If agent is found to be present in the MPT/CST condensate, the latter will first be treated in the agent reactors, where agent destruction will be completed and the resultant hydrolysate sent to bioreaction.

Noncondensable gases will be sent to the CATOX® offgas treatment system dedicated to the MPTs.

4.15.1 ROTARY MPT, 070-MPT-101

The design throughput for the RMPT is 120 rounds/hr for 105-mm and 4.2-inch munitions and 60 rounds/hr for 155-mm munitions. (Refer to Figure 4-14.) The RMPT uses external induction coils as the primary heat source, with a process heat load of 250-kW (installed duty 450 kW), and uses superheated steam as the carrier gas. The dimensions of the RMPT are 4-ft 8-inches ID by 15-ft 7-inches with design conditions of 15 psig/full vacuum at 1,500ºF. The RMPT will be constructed of Hastalloy C-276.

RMPT is a cylindrical structure rotating at a prescribed speed inside of a cylindrical furnace. The cylindrical structure contains 15 cages evenly distributed around a 36-inch outside diameter inner pipe supported and strengthened by baffles.

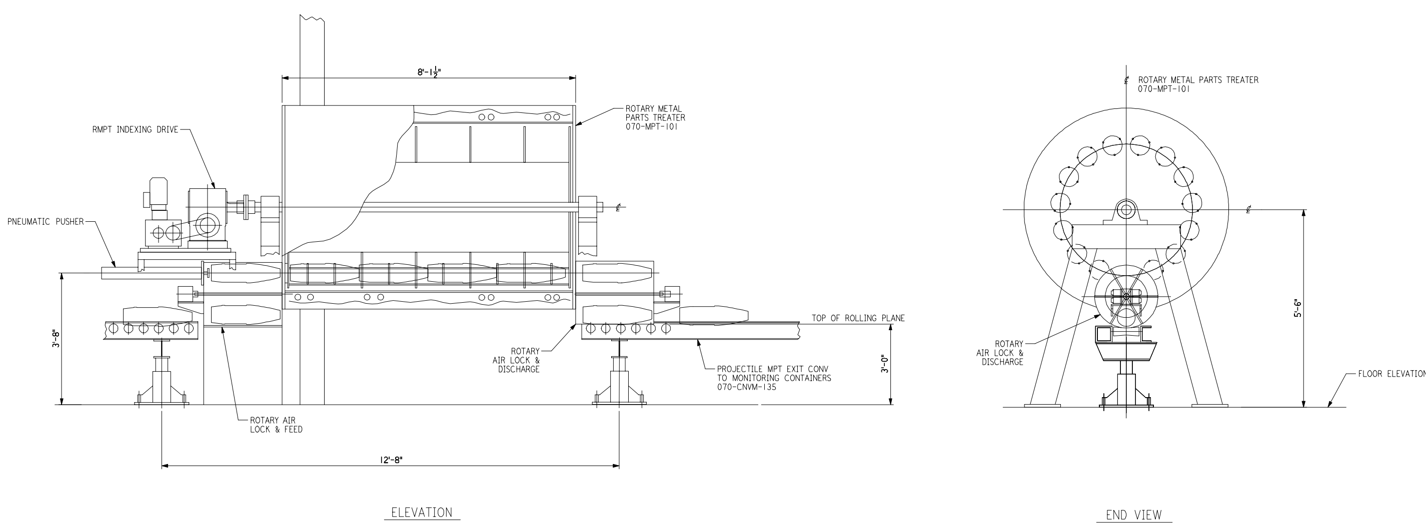


Figure 4-14—Rotary Metal Parts Treater

Munitions loading will be into these cage structures. Each cage is made with three ½-inch diameter stainless steel rods, positioned at a 120-degree angle and parallel in the axial direction. The inside diameter of the cage is determined just to accommodate the munitions or mortars without misaligning or jamming. Different size cages will be used for different munitions and mortars.

The length of the RMPT was determined by performing thermal analyzes. The iteration, while changing the furnace length continued until the process goal was met. The primary process goal was to meet the 5X conditions (15 minutes at or above 1,000°F) for all the munitions treated in the RMPT. Another requirement was to match the throughput rate of the upstream MDB machine. At this point of the process design effort, it is determined that the furnace should accommodate, in a row, ten 105-mm munitions, seven 155-mm munitions, or ten 4.2-inch mortars. The length of the cage is determined at 167 inches and the furnace 187 inches.

The RMPT assembly of cages, baffles, and inner pipe is rotated at a speed determined for each type of munitions: one revolution per 7 minutes and 30 seconds for 105-mm projectiles and 4.2-inch mortars, and 15 minutes for 155-mm projectiles. While the assembly is rotating or indexed at the prescribed speed, one 105-mm projectile or 4.2-inch mortar is loaded every 30 seconds, and one 155-mm projectile is loaded every minute. At the same time as a munition is loaded on the front end, one is discarded at the discharge end of the furnace. Then resulting total residence time for each munition is 75 minutes for 105-mm projectiles and 4.2-inch mortars (or 10 rows or complete revolutions), and 105 minutes for the 155-mm projectiles (or 7 rows/revolutions).

4.15.2 FURNACE WALL AND HEAT SOURCE

The munitions are heated primarily by radiation originating from the cylindrical furnace shell of 54-inches ID and 187-inches long. At both ends of the furnace, there are insulated disc plates equipped with munition/mortar loading and unloading devices.

The furnace wall is first heated by induction power supplied from an radio frequency (RF) generator. Since the load heating is by radiation, certain radiative properties of the furnace material become important parameters. One of these is the emittance. The shell material needs to have high emittance as well as good chemical resistance to corrosion, to resist the acid gases generated during the operation.

The entire furnace wall area needs to be maintained uniformly at 1,250°F. If not, the thermal gradient of the furnace wall will cause an inefficiency due to heat exchange between furnace segments at different temperatures, rather than heat up the munitions.

The RMPT steam superheater, 070-HEAT-103, is used to supply 1,000°F superheated steam to the RMPT. The unit will be a packaged manufacturer's standard unit sized for designed for 25-kW, 15-psig/full vacuum at 1,500°F with a capacity of 15,000 Btu/hr.

The RMPT effluent heater, 070-HEAT-101, is used to heat the RMPT effluent to approximately 1,200°F to ensure total destruction of HD present in the vent gas. The unit will be a manufacturer's standard unit designed for 25-kW, 15-psig/full vacuum at 1,500°F with a capacity of 50,000 Btu/hr and a residence time of 0.5 second.

The MPT quench tower, 070-TOWR-101, receives the heated vent gases from the RMPT, BMPT, ERD and ENRs, and contacts the gases with a recirculating alkaline brine solution and the resultant noncondensable vent gases sent to the offgas treatment CATOX® units. The quench tower will be made of Hastalloy C-276 and designed for a feed rate of 8000 ACFM, 15-psig/full vacuum at 175°F with tower dimensions of 1-ft 6-inches ID by 12-ft 0-inch T/T.

The MPT condensate surge tank, 070-TANK-101, receives the purge stream from the recirculating brine which will be sent to the MPT/CST condensate holding tanks. The tank will be provided with 750 gallons capacity, with dimensions of 4-ft 0-inch ID by 8-ft 0-inch high, constructed of hastelloy C-276 or plastic. Design conditions for the tank are 15 psig, full vacuum at 175°F.

ACWA EDS testing indicated a need for a mist eliminator pad in the MPT condensate surge tank to prevent liquid carryover.

4.16 CONTINUOUS STEAM TREATMENT

Reference PFD: AAC-50-F-075 Continuous Steam Treater

AAC-50-F-120 Contaminated Waste Preparation

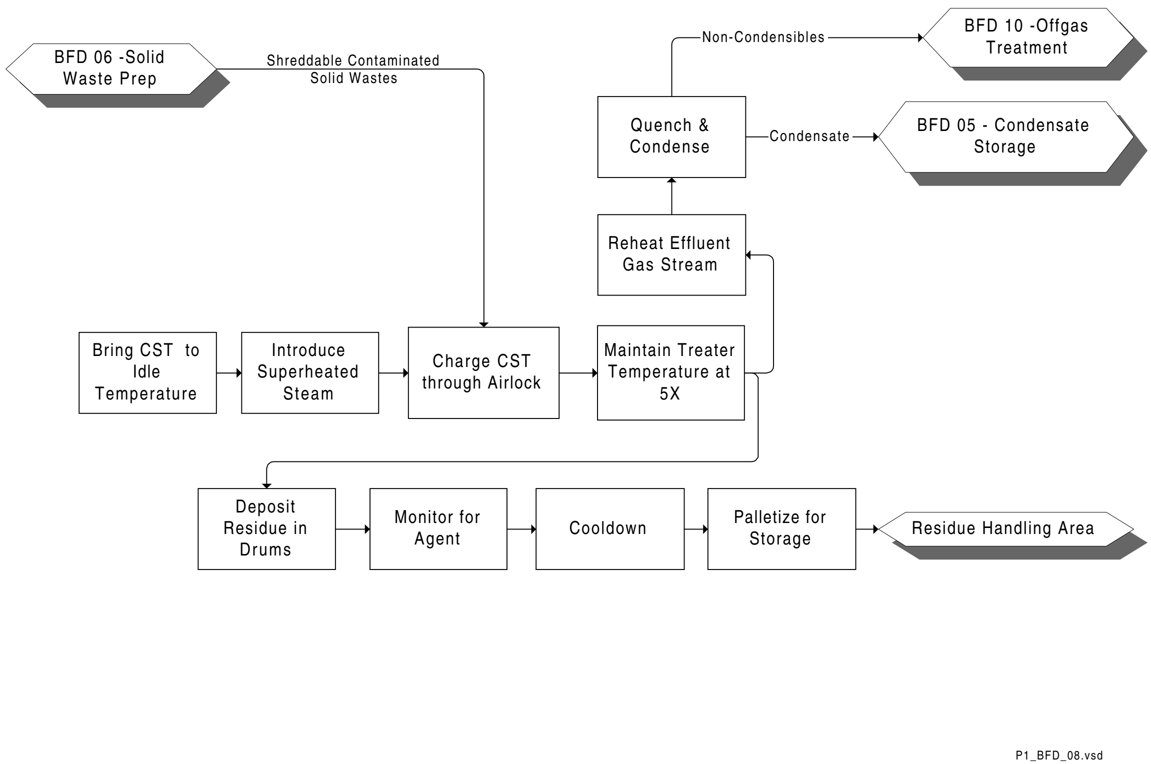


Figure 4-15—Continuous Steam Treatment

The continuous steam treater (CST) system is designed to achieve 5X conditions for plant non-process wastes and dunnage, by heating the materials to 1,000°F and holding at that temperature for a minimum of 15 minutes. Shredded wood pallets, spent activated carbon from the HVAC carbon beds, and shredded plastic (DPE with boots and gloves) will be treated in the CST unit. The CST system operates in a continuous feed mode to decontaminate each feed type. The shredded wood and shredded DPE feeds will be mixed with an aggregate material to add bulk to the feed materials and also to act as a scouring agent for the CST shell.

Feed aggregate/carrier material (crushed tabular alumina or other suitable material) is needed to provide bulk to shredded feedstock such as wood or plastic (DPE). ACWA EDS CST testing will recommend the type and quantity of aggregate and the appropriate feed mixture to aggregate ratios.

The ACWA EDS WHEAT full-scale design for the CST is based on hourly feed ratios based on 100 lb wood:200 lb aggregate; 15 lb DPE:285 lb aggregate; mixed feed at 15 lb DPE:85 lb wood: 200 lb aggregate. Aggregate attrition rate is assumed to be 10% of the feed aggregate. This quantity will be recalculated based on CST testing results. Carbon is fed alone (no aggregate) at 300 lb per hour.

ACWA EDS WHEAT full-scale design is based on CST mechanical design as tested. This design is subject to modification based on CST test results and recommendations for design modifications. Steam feed flow rate is at 50% excess of stoichiometric reaction needs, superheated to 1,000°F. The feed solids must be maintained at 1,000°F for a minimum of 15 minutes. CST vent gases must be heated and maintained at 1,200-1,250°F at the CST effluent reheater for a minimum residence time of 0.5 second.

The CST uses steam as a carrier gas. Prior to commencing the steam treatment, the heating chamber is purged with nitrogen to create an inert atmosphere. Steam is superheated to 1,000°F prior to feeding into the CST chamber.

4.16.1 CST Feed Material

The CST will be used for destroying potentially agent-contaminated waste such as contaminated wood pallets, boxes, DPE suits, and charcoal filters. Most of the waste except charcoal filters will be generated in UPA and PRR. Plastic wrapping will contain the contaminated waste as generated and will be fed to shredders for CST processing.

Metal parts are separated from the DPE suits as the suits are removed and before placing them in overpack bags. The metal parts are then treated through the BMPT.

The other major waste generated will be in the filter area located north of MDB. The spent Contaminated filters as removed will be packaged in the plastic bag and placed in the temporary storage for later CST processing in the MDB.

The waste generated in the TMA due to leaker campaign will be in the form of DPE suits and contaminated wood pallets. This waste will be packaged in plastic bags for transfer to two shredders in feed conveyors.

The bagged contaminated wood pallets and DPE suits will be removed from TMA air lock and loaded on to the motorized pallet trucks and forklifts for transfer through the UPA to two shredders in feed conveyors for processing.

4.16.2 Contaminated Waste Preparation

A typical operating scenario for the CSTR consists of receiving contaminated wood pallets/boxes and DPE suits by forklift/pallet trucks. The plastic suits and wood will be introduced into the shredding room through dedicated airlocks located on the west wall of the CSTR. The two dedicated shredders one for wood and the other for DPE suits will be located in the shredding room. Flexible screw conveyors will transfer the shredded material from the respective shredders to an enclosed belt conveyor through a surge bin/loss in weight feeder system.

All material as being shredded will drop down to the bottom compartment of the shredder along with any minor dust/small particles that may have generated in this operation. The enclosed screw conveyor will transfer shredded material along with settled dust/small particles through a closed conveyor system to the CST. A dedicated dust collection is not necessary for this type of system as very minimal dust is generated in the shredding and settles down along with the larger particles at the bottom of the shredder.

Any metal such as nails generated from the wood shredding operation will be collected and placed in miscellaneous parts container for transfer to the batch MPT for the treatment.

Flex screw conveyor will transfer alumina as aggregate from the storage bin onto the enclosed belt conveyor carrying shredded wood and plastic suits to CST. The material will be dropped into the CST through a double flap gate airlock valve. The mixture will be thermally treated as it moves towards the CST discharge end by the CST auger. The discharged mixture in the form of ash and alumina will be transferred to a classifier for separation by a water-cooled screw conveyor.

The classifier will separate the ash, which will be collected in ash bins through a gravity chute and alumina will directly be deposited in the storage bin for recycle.

4.16.3 CST AND CST OFFGAS TREATMENT

The CST will provide 5X decontamination (1,000°F for 15 minutes) of the dunnage, using external inductive heating and the steam inside. The steam passes through the CST countercurrent to the flow of solid feed; steam enters near where the treated dunnage discharges and exits the near the dunnage feed end.

Solid materials discharged from the CST will be separated into two components: ash (to be monitored and drummed for disposal) and aggregate. The aggregate will be blended with dunnage and will be fed again to the CST.

The largest CST system component is an induction furnace. This is a 300-kW inductively heated horizontal cylinder, approximately 5-ft diameter by 15-ft long. The shell is to be constructed of Hastelloy C-276. Contained within the shell is a rotating, multibladed auger shaft that rotates in a 30-inch diameter trough running the length of the furnace. Material (dunnage plus aggregate) is fed at one end of the furnace. The steam enters the opposite end of the furnace. Feed material transits the length of the furnace in approximately 1 hour (controlled by auger shaft rotation speed and blade pitch). Residual solids exit the furnace through a discharge air lock.

Volatized gases and steam exit the feed end of the furnace and enter an induction re-heater. The re-heater ensures process gases are elevated to approximately 1,200°F with a minimum residence time of 0.5 seconds. Re-heater discharge flow enters the quench tower.

The quench tower receives hot gases from the re-heater and uses evaporative cooling spray to condense steam and reduce process outlet temperature to approximately 150°F. A purge stream, from the recirculating brine, will be sent to the MPT/CST condensate holding tanks, and from there, if agent free, to bioreaction via the agent hydrolysate tank.

The continuous steam treater, 075-CST-121, will accomplish a decontamination level of 5X, 1,000°F maintained for 15 minutes, in shredded contaminated material from wood pallets, DPE suits and spent carbon. The design throughput for the CST will be 300 lb/hr. The MPT uses external induction coils as the primary heat source, with a heat load of 300 kW, and superheated steam as the carrier gas. The dimensions of the CST are 4-ft 8-inches ID by 11-ft 0-inch with design conditions of 15-psig/full vacuum at 1,500°F. The CST will be constructed of Hastalloy C-276.

The CST steam superheater, 075-HEAT-122, is used to supply 1,000°F superheated steam to the CST. The unit will be a packaged manufacturer's standard unit sized for designed for 25-kW, 15-psig/full vacuum at 1,500°F with a capacity of 30,000 Btu/hr.

The CST effluent heater, 075-HEAT-121, is used to heat the CST effluent to approximately 1,200°F to ensure total destruction of HD present in the vent gas. The unit will be a manufacturer's standard unit designed for 25-kW, 15-psig/full vacuum at 1,500°F with a capacity of 24,000 Btu/hr and a residence time of 0.5 second.

The CST quench tower, 075-TOWR-121, receives the heated vent gases from the CST and contacts the gases with a recirculating alkaline brine solution. The quench tower will be made of Hastalloy C-276 and designed for a feed rate of 8000 ACFM, 15-psig/full vacuum at 175°F with tower dimensions of 1-ft 6-inches ID by 12-ft 0-inch T/T.

The vent gas from the quench tower system is further treated in the CATOX® offgas treatment system. (Refer to Section 4.18.)

The CST condensate surge tank, 075-TANK-121, receives the purge stream form the recirculating brine which will be sent to the MPT/CST condensate holding tanks. The tank will be provided with 750 gallons capacity, with dimensions of 4-ft 0-inch ID by 8-ft 0-inch high, constructed of stress relieved carbon steel or plastic. Design conditions for the tank will be 15 psig, full vacuum at 175°F.

ACWA EDS testing indicated a need for a mist eliminator pad in the CST condensate surge tank to prevent liquid carryover. Also testing indicated the need for antifoam addition for the CST quench system to prevent foaming in the quench tower and surge tank.

4.17 BATCH METAL PARTS TREATMENT

Reference PFD: AAC-50-F-076 Batch Metal Parts Treatment

4.17.1 MPT BATCH PROCESS

While the main bodies of 105-mm, 155-mm munitions, and 4.2-inch mortars are processed in the RMPT, the internal parts taken out from these munitions are collected into rectangular boxes and put through batch processes in another MPT. (Refer to Figure 4-16.) These parts are burster wells, burster tubes, fuzes, nose cones, lifting lugs, plugs, etc.

The batch metal parts treater, 076-MPT-101, will accomplish a decontamination level of 5X, 1,000°F maintained for 15 minutes, in burster wells from WMDM, burster tubes, fuzes, booster cups, nose closure plugs and miscellaneous parts from projectile disassembly. (Refer to Figure 4-17.) The design throughput for the BMPT will be three 3-ft by 3-ft by 2-ft containers/batch. The BMPT uses external induction coils as the primary heat source, with a heat load of 450 kW, and superheated steam as the carrier gas. The dimensions of the BMPT are 4-ft 8-inches ID by 11-ft 0-inch with design conditions of 15-psig/full vacuum at 1,500°F.

The BMPT steam superheater, 076-HEAT-102, is used to supply 1,000°F superheated steam to the BMPT. The unit will be a packaged manufacturer's standard unit sized for designed for 50-kW, 15-psig/full vacuum at 1,500°F with a capacity of 138,000 Btu/hr.

The BMPT effluent heater, 076-HEAT-101, is used to heat the BMPT effluent to approximately 1,200°F to ensure total destruction of HD present in the vent gas. Re-heater discharge vent gases are sent to the MPT quench tower. The unit will be a manufacturer's standard unit designed for 50-kW, 15-psig/full vacuum at 1,500°F with a capacity of 94,000 Btu/hr and a residence time of 0.5 second.

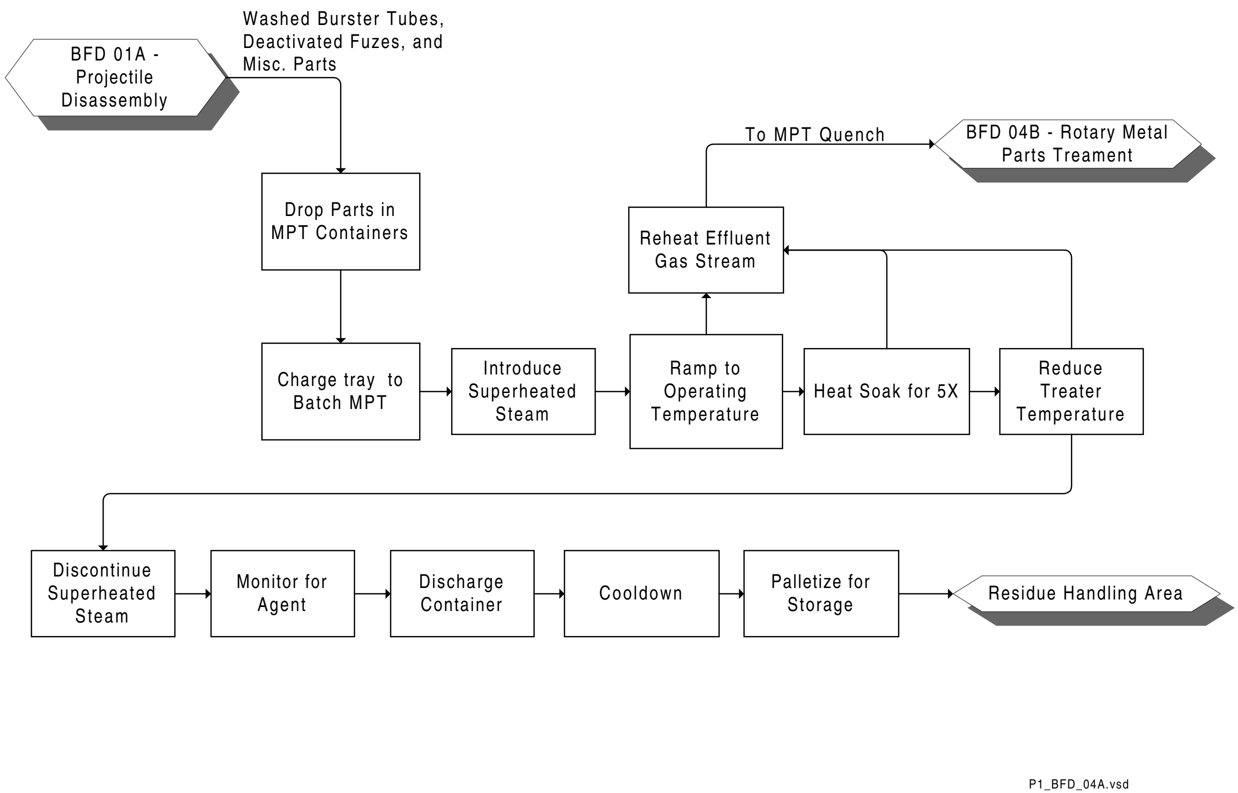


Figure 4-16—Batch Metal Parts Treatment

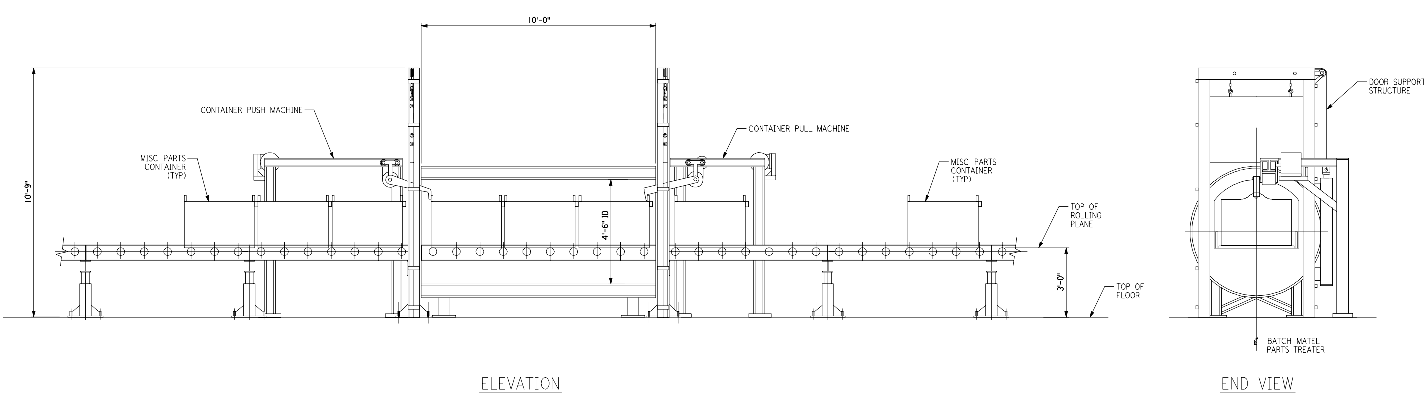


Figure 4-17—Batch Metal Parts Treater

4.18 OFFGAS TREATMENT

Reference PFD:	AAC-01-F-080	Offgas Treatment - MPT
	AAC-50-F-085	Offgas Treatment – CST
	AAC-40-F-087	Offgas Treatment – Bioreactor

The ACWA EDS WHEAT full-scale systems use catalytic oxidation as a localized method of process offgas treatment. There are three systems involved. As illustrated in Figure 4-18, these are the offgas treatment systems for the MPTs, CST and bioreactor process vent gases.

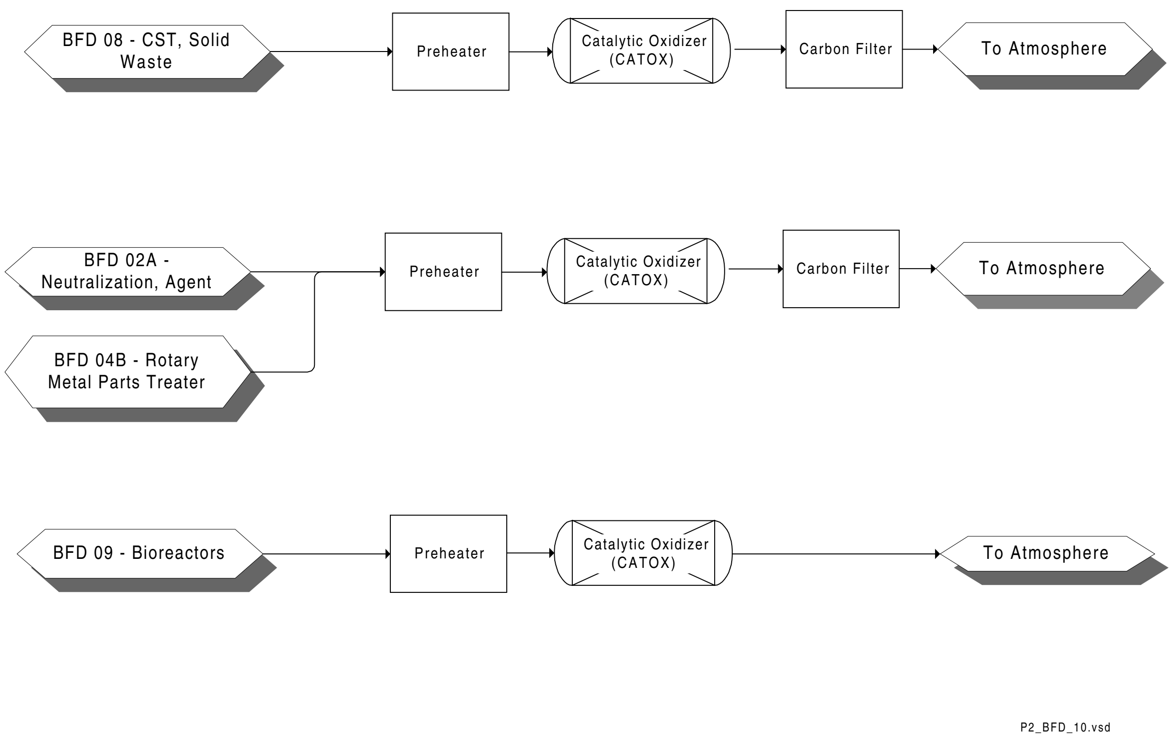
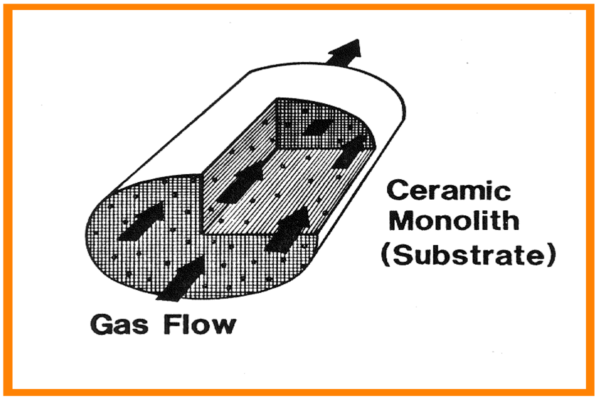


Figure 4-18—Offgas Treatment Systems

Trace pollutants in the process vent streams from the MPTs, the CST, reactors and hydrolysate tank vents, the ERD, and the ICB™ will be removed by catalytic treatment. In theory, the reactant molecules (e.g., VOCs and oxygen) diffuse to the catalyst surface and are adsorbed onto the catalyst. On the catalyst surface, the reactants dissociate into fragments and atoms. Following surface reactions, the end products then desorb from the surface back into the flow stream. Thus, the catalyst facilitates the reaction by providing a low energy pathway for the reaction to occur (in other words, it lowers the activation energy). (Refer to Figure 4-19.)

The catalyst will be supported on straight channel, ceramic monolith substrates that provide higher catalytic efficiencies with minimum pressure drop. Typically, the monolith channels are coated with a high-surface-area inorganic oxide (e.g., Al_2O_3) "washcoat" to improve the dispersion and durability of the active component. The active component is loaded onto the washcoat in an impregnation step.

The catalytic reactor is designed to operate under external mass transfer rate control. That is, the rate of destruction is determined by the rate the reactant molecules diffuse from the bulk flow stream to the surface of the catalyst. The actual surface reaction occurs much faster than the diffusion step. In this way, standard mass transport equations and fluid dynamics can be used to design the catalytic reactor to give a desired conversion and pressure drop for given inlet conditions.



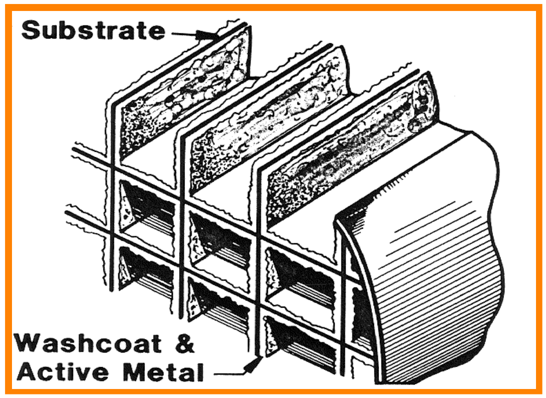


Figure 4-19–Catalytic Oxidizer Cutaway Diagrams

In typical operations, the flow inlet is brought to the desired temperature by heating. This heated air is brought into the catalytic reactor where the trace pollutants are destroyed. The reactor will be composed of a series of monolithic catalyst segments to improve mass transfer properties. The outlet air can then be passed through a heat exchanger to recover some of the energy and then exhausted to the MDB filter system.

The proprietary Honeywell catalyst formulation to be used was developed specifically for its resistance to common catalyst poisons such as halogens, sulfur, and phosphorus. This catalyst has been tested extensively against compounds containing common catalyst poisons, chemical agents and has shown high-destruction efficiencies and durable performance. (ACWA EDS CATOX® HD challenge testing at 10-30 mg HD per cubic meter of air was concluded successfully in October 2000. The test results and lessons learned will be incorporated in full-scale design pending publication of the test report and recommendations.)

The bioreactors will be equipped with their own CATOX® systems. These are not anticipated to ever see agent and are provided solely to deal with any VOCs stripped from the ICB™ feed by the bioreactor aeration or generated by the biota in the reactor. Each bioreactor module (comprising 4 ICB™ units) will be equipped with a dedicated CATOX® offgas treatment system.

The three CATOX® systems operate in the same manner. Incoming air streams are heated electrically to about 800-840°F, to bring the gas streams within the CATOX® catalyst active temperature. This active temperature can be lowered to about 700°F, if upstream process conditions impose a heavier than anticipated organic (or oxidation) load on the CATOX® unit. The maximum sustained operating temperature at the discharge of the catalyst bed is 1,050°F. Operation at temperatures above this will result in gradual loss of catalyst activity and it is to be avoided. Process control systems are in place to stay within the operating limits; these are discussed in subsection 7.2.5, Monitoring and Control Strategy – MPT/CST Offgas Treatment.

The proprietary Honeywell catalytic matrix destroys all organic materials. The bioreactor CATOX® units discharge directly to the atmosphere. The MPT and CST system vent CATOX®

unit(s) discharge to the MDB filter system as a precaution. The MDB filter system discharges to the atmosphere.

The MPT offgas reheater, 080-HEAT-106, takes incoming gases from the MPT agent condensate surge tank vent, the agent hydrolysers, and the agent hydrolysate tank vents and heats the mixed stream electrically (by using electric induction coils) to reduce moisture content and condition the gas streams to the CATOX® operating temperature. The unit is a manufacturer's standard unit sized for 450 kW with a capacity of 1.2 MMBtu/hr and design conditions of 15-psig/full vacuum at 1,000°F.

The MPT offgas CATOX® treater, 080-CATX-101, receive the heated gases from the MPT offgas reheater and through the proprietary Honeywell catalytic matrix destroying residual VOCs and semi-VOCs. The unit has a capacity of 1260 scfm, 25-inch water column pressure drop and dimensions of 2-ft 0-inch diameter by 4-ft 0-inch flange-flange (F/F).

The MPT offgas cooler, 080-EXCH-102, receives the heated air stream from the CATOX® treaters and cools the stream prior to entering the HVAC carbon filters. The cooler will be rated for a duty of 1.2 MMBtu/hr with design conditions of 15-psig/full vacuum at 925ºF (tubes). The tubes of the cooler will be constructed of alloy 20 with a carbon steel shell.

The MPT offgas blower, 080-BLOW-106, transfers the cooled CATOX® exhaust and transfers the gas to the HVAC carbon filters. The exhaust blower will provide enough flow and draw to keep the complete system at a pressure slightly less than ambient. The blower will have a capacity of 1260 scfm and be sized for 72 BHP, 100 HP.

The CST offgas reheater, 085-HEAT-106, takes incoming gases from the CST condensate surge tank and heats the stream electrically to reduce moisture content and condition the gas streams to the CATOX® operating temperature. The unit will be a manufacturer's standard unit sized for 450 kW with a capacity of 1.0 MMBtu/hr and design conditions of 15-psig/full vacuum at 1,000°F.

The CST offgas CATOX® treaters, 085-CATX-101, receive the heated gases from the CST offgas reheater and through the proprietary AlliedSignal catalytic matrix destroys residual VOCs and semi-VOCS. The unit will have a capacity of 1040 scfm, 25-inch water column pressure drop and dimensions of 2-ft 0-inch diameter by 4-ft 0-inch F/F.

The CST offgas cooler, 085-EXCH-102, receives the heated air stream from the CATOX®/CATOX® treaters and cools the stream prior to entering the HVAC carbon filters. The cooler will be rated for a duty of 1.0 MMBtu/hr with design conditions of 15 psig/full vacuum at 925ºF (tubes). The tubes of the cooler will be constructed of 1-1/4 Cr - 1/2 Mo with a carbon steel shell.

The CST offgas blower, 085-BLOW-106, transfers the cooled CATOX®/CATOX® exhaust and transfers the gas to the HVAC carbon filters. The exhaust blower will provide enough flow and draw to keep the complete system at a pressure slightly less than ambient. The blower will have a capacity of 1040 scfm and be sized for 60 BHP, 75 HP.

The ICB™ offgas reheater, 087-HEAT-101/2/3/4, takes incoming gases from the ICB™ modules and brine reduction system vents, and heats the stream electrically to reduce moisture content and condition the gas streams to the CATOX® operating temperature. Four heaters are required; each will be a manufacturer's standard unit rated for 720 kW with a capacity of 2.4 MMBtu/hr and design conditions of 15 psig at 1,000°F.

The ICB™ offgas CATOX® treaters, 087-CATX-101/2/3/4, receive the heated gases from the ICB™ offgas reheater and through the proprietary AlliedSignal catalytic matrix destroys residual VOCs and semi-VOCS. Four CATOX® treaters are required; each unit will have a capacity of 6400 scfm, 25-inch water column pressure drop, and dimensions of 4-ft 6-inch diameter by 4-ft 0-inch F/F.

The ICB™ offgas blowers, 087-BLOW-101/2/3/4, transfer the cooled CATOX® exhaust and transfers the gas to the HVAC carbon filters. The exhaust blowers will provide enough flow and draw to keep the complete system at a pressure slightly less than ambient. Four blowers will be required; each will have a capacity of 6400 scfm and be sized for 200 BHP, 250 HP.

The CATOX® offgas economizers, 087-EXCH-101/2/3/4, are gas-to-gas heat exchangers used to heat the CATOX® feed with CATOX® effluent. Four exchangers will be required; each will be rated for 4.3 MMBtu/hr with design conditions of 75 psig at 1,000°F and be constructed of 1-1/4 Cr - 1/2 Mo carbon steel exposed.