AIR FORCE TACTICS, TECHNIQUES, AND PROCEDURES 3-32.19

24 SEPTEMBER 2018

RAPID AIRFIELD DAMAGE RECOVERY
ASPHALT BATCH PLANT OPERATIONS

DEPARTMENT OF THE AIR FORCE

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BY ORDER OF THE SECRETARY OF THE AIR FORCE

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Tactical Doctrine

RAPID AIRFIELD DAMAGE RECOVERY ASPHALT BATCH PLANT OPERATIONS

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PURPOSE: To provide tactics, techniques, and procedures (TTPs) for asphalt batch plant operations during Rapid Airfield Damage Repair (RADR). It supports Air Force Instruction (AFI) 10-210, *Prime Base Engineer Emergency Force (BEEF) Program*, AFPAM 10-219, Volume 4, *Airfield Damage Repair Operations*, and Air Force Doctrine Annex 3-34, *Engineer Operations*. Ensure that all records created as a result of processes prescribed in this publication are maintained IAW Air Force Manual (AFMAN) 33-363, *Management of Records*, and disposed of IAW the Air Force Records Disposition Schedule (RDS) in the Air Force Records Information Management System (AFRIMS). Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate functional chain of command.

APPLICATION: This publication applies to all regular Air Force, Air National Guard, and Air Force Reserve Command Civil Engineer personnel performing RADR asphalt batch plant operations. This document is authoritative but not directive. The asphalt batch plant operations TTPs in this publication take precedence over those found in other nondirective publications. Applicable AFIs take precedence when this publication and those AFIs conflict.

SCOPE: This publication provides TTPs to produce asphalt concrete with a contingency batch plant after an attack. It provides resource requirement information for manpower, vehicle, equipment, and repair material; preparatory actions taken prior to an attack and before commencing repair activities. Finally, the publication describes batching, stockpiling, and delivery of asphalt to airfield pavement repair personnel.

The TTPs within this publication are best practices as determined by the Airbase Acquisition Branch, Air Force Civil Engineer Center (AFCEC/CXAE). Where applicable, use procedures found in applicable manufacturer's owners/operators manuals for specific asphalt recycler make and models.

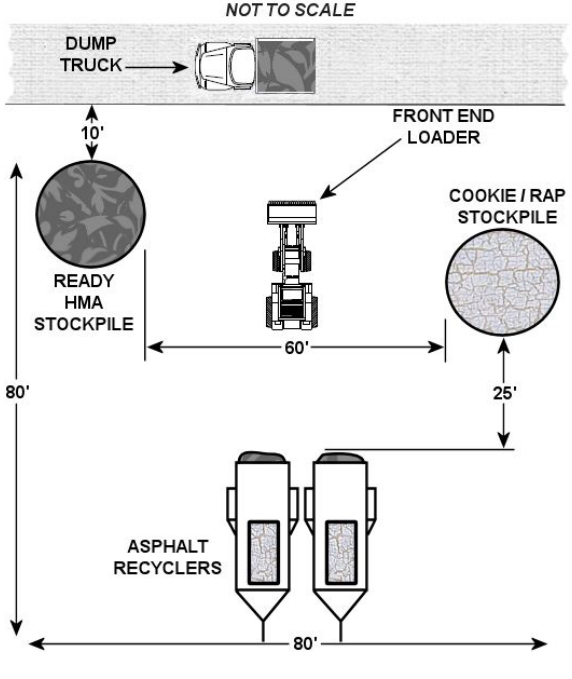
The use of name, procedures, or mark of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force.

Chapter 1
INTRODUCTION

1.1. Overview. The Rapid Airfield Damage Repair (RADR) mobile asphalt recyclers are used to batch hot-mixed asphalt (HMA) from virgin asphalt blocks (referred to as cookies in this publication), reclaimed asphalt pavement (RAP), and/or pelletized asphalt for crater repairs with an asphalt cap. Asphalt batching is accomplished when airfield repairs require asphalt caps, typically when making repairs to asphalt pavement. One batch plant supports up to two crater repair teams.

1.2. Asphalt Batch Plant Layout. Batch plants should be located within a seven minute commute to the airfield. The asphalt batch plant requires space with a stabilized surface for storing asphalt products (i.e. asphalt cookie stockpiles, RAP, HMA stockpiles), operational space for two recyclers, and space to load RADR warehouse dump trucks. **Figure 1.1** provides an example batch plant layout.

Figure 1.1. Typical Asphalt Batch Plant Layout.



1.2.1. Batching may be setup indoors (e.g., inside a hangar) during inclement weather conditions, but proper ventilation and sufficient clearance to overhead structures must be provided when batching indoors. Batch plants may also be collocated with a RADR warehouse (see AFTTP 3-32.18, *RADR Warehouse Operations*).

1.2.2. Position recyclers on stable ground and that is as level as possible. Use a mat under jack feet when setup on soft ground.

1.2.3. Clear area of flammable materials and ensure area is clear of overhead structures and utilities. In addition, position recyclers clear of air handling systems of nearby structures.

1.2.4. Locate recyclers in close proximity to one another so that one operator may operate both recyclers simultaneously, and to provide one general area for collecting the HMA for loading dump trucks or stockpiling (**Figure 1.1**). One front end loader (FEL) and operator is dedicated to load the hopper (also known as the charging box/tray, but will be referred to as the hopper from this point on) on both recyclers and to load the produced HMA in dump trucks, or create HMA stockpiles when dump trucks are full or delivering asphalt to the airfield.

1.2.5. In many instances, the 4-yard buckets delivered with the RADR FELs are too large to fit under the recycler discharge chute, even when the jacks are fully raised (this issue is being addressed in future purchases). It is recommended an inventory be conducted on FEL buckets on the installation to determine if there is smaller 4-yard bucket that fits under the recycler discharge chute, or if there is a 2-yard bucket, and designate that bucket for Asphalt Batch Plant operations. If a smaller bucket is not found, choose from one of the following options as a solution:

- Dig a pit beneath the discharge chute; however, this option is not suitable for batching indoors during inclement weather)
- Park recyclers on an elevated platform, such as 2” x 8” lumber
- Use a back-hoe to drag the HMA from underneath the discharge chute

1.3. Resources. Table 1.1 lists Asphalt Batch Plant Unit Type Codes (UTCs). **Table 1.2** identifies manning requirements and their duties and responsibilities.

Table 1.1. RADR Asphalt Batch Plant UTCs.

Capabilities	Small	Medium	Large	Very Lg
4FWAE – RADR Asphalt Batch Plant Operations				
Asphalt Recycler Set (2 per set)	1	2	3	4
Front End Loader	1	2	3	4
4FWAB – WRM RADR Asphalt Crater Repair Material				
Flowable-Fill (Super Sacks)	84	252	420	588
*Asphalt (Tons)	40	120	200	280
*At the time of publishing it was not determined if asphalt will be included in 4FWAB or if the user will have to source material locally. **Note:** Flowable fill will be postured at the applicable warehouse. Asphalt will be stockpiled at the asphalt batch plant.				

Table 1.2. Asphalt Batch Team Required Resources.

Position	Suitable AFSCs	Veh/Equip/Tools
Lead/Operator	Primary: 3E2X1 Subs: 3E3X1, 3E4X3, 3E5X1, 3E6X1	Loader
Operator	Primary: 3E0X2, Subs: 3E0X1, 3E1X1, 3E2X1	Asphalt Recyclers
Helper	Any	Shovel, Rake, etc.
Note: Hand tools, infrared thermometers, and release agent and sprayers can be found in the RADR Tool Trailers (UTC 4FWCR). **Note:** A light cart from the 4FWCR UTC is earmarked for the asphalt batch plant for nighttime operations.		

1.3.1. **Logistics Chief.** A primary responsibility of the Logistics Chief is to ensure batch teams are completing their assigned tasks as efficiently as possible and to help remove obstacles that negatively impact their operations. The Logistics Chief also stays informed on batch plant operations to include RAP stockpiles, batch start times, total HMA produced, HMA maximum hold times, and delivery schedules.

1.3.2. **Batch Plant Team Lead.** The Batch Plant Lead operates the recyclers and manages the production of asphalt for applicable repairs. He/she ensures produced asphalt is loaded in warehouse dump trucks to be delivered to the airfield at

appropriate times as directed by the Warehouse 1 Lead. Each plant supports up to two repair teams and receives directions from the Warehouse 1 Lead on when to begin and stop production. Raw asphalt material (e.g., cookies or rap) inventory, production, hold times, and deliveries are reported to the Logistics Chief so actions may be initiated to share material with other batch plants as needed, and acquire, or produce additional materiel if shortages are expected.

1.3.3. **Warehouse 1 Team Lead.** When supporting asphalt repairs, the Warehouse 1 Lead manages all aspects of asphalt production and delivery. He/she determines the number of plants required to meet the required tonnage, when to start production to ensure asphalt is ready for placement, but not stockpiled long enough to cool below 270°F before placement, and when to begin plant shutdown. He/she also manages the delivery schedules from the batch plants to appropriate repair zones.

1.4. Asphalt Recycler. The asphalt recycler in the 4FWAB UTC is a tandem axle trailer weighing 11,000 pounds and can be towed by any 1.5-ton vehicle. When transporting, adjust the drawbar so the recycler is in a horizontal positon and the permitted supporting load will not be exceeded. The recycler's intended use is recycling cold asphalt mix (fines, milling asphalt) and broken slabs up to 11.8 inches by 15.75 inches by 4 inches.

1.4.1. The hopper on top of the recycler is loaded with a FEL; the hopper tilts and dumps material into the tumbler chute as needed. Do not fill more than 4,400 lbs into the recycler tumbler, which corresponds to 1,015 psi (70 bar) on the hydraulic oil pressure gauge. The unit uses a rotating drum with internal baffles to tumble the asphalt through a bath of hot air. **Figure 1.2** shows an external profile view of the asphalt recycler and **Figure 1.3** portrays the internal profile view.

Figure 1.2. Asphalt Recycler External Profile View.

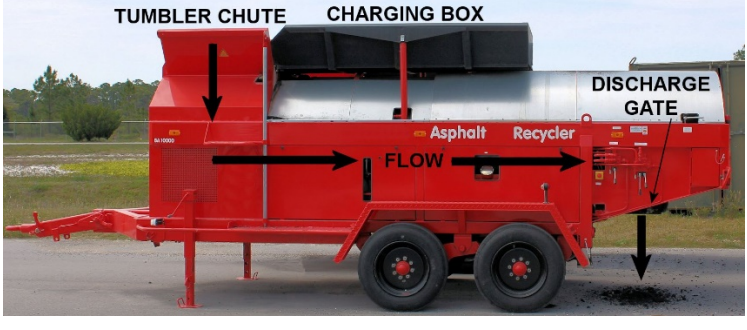
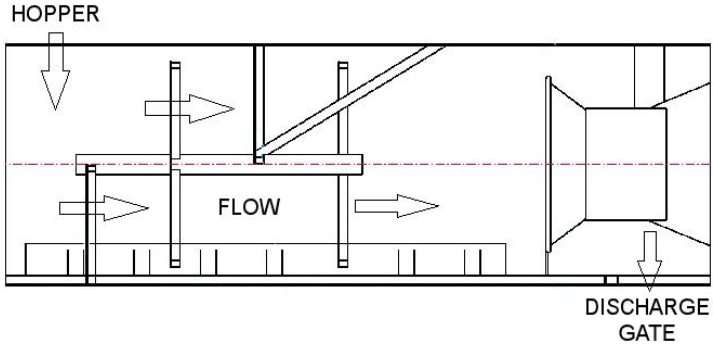


Figure 1.3. Asphalt Recycler Internal Profile View.



1.4.2. The hot air is produced by a diesel fired, twin stage burner at the rear of the drum (**Figure 1.4**). The burner introduces hot air into the drum through a coned opening in the end of the drum; this prevents direct contact of the flame with the material being heated. The burner is equipped with four settings: off, fan only, low heat, and high heat.

Figure 1.4. Asphalt Recycler Burner (Rear Hatch).

1.5. Remote Operation. A 25-foot hydraulic control umbilical (**Figure 1.5**), which can be connected to either side of the recycler, provides an efficient means to operate both recyclers simultaneously. Umbilical functions include:

- Drum forward and reverse with detent in forward position
- Hopper up and down with detent in lower position

- Drum high speed; engage and disengage

Note. Never reverse drum or open door while in high speed

- Open Door—Operate drum reverse direction - hold door switch in open position. When drum stalls, release door switch. Engage drum in forward position (detented).
- Close Door—Operate drum in normal forward direction (detented). Move door switch to closed position. When drum stalls, release door switch. Reverse Drum one (1) rotation and then back to forward or detented position.

Figure 1.5. Hydraulic Control Umbilical.

1.6. Training. Pavements and Construction Equipment (3E2X1) and Electrical Power Production (3E0X2) personnel receive asphalt recycler training at home station via computer based training on the Civil Engineer Virtual Learning Center, and hands-on training during Silver Flag training.

Chapter 2
ASPHALT MIX DESIGN AND STORAGE TECHNIQUES

2.1. Overview. The recommended mix design in UFC 3-250-03, *Standard Practice Manual for Flexible Pavements*, is for a gradation 2 (12.5 mm or 0.5 inch) nominal HMA Pavement (see AFH 32-1034, *Materials Testing*, for gradation testing instructions). If the recommended mix design is not available, experiments have shown that a locally procured HMA SP-12.5 provides adequate performance. **Table 2.1** shows the UFC 3-250-03 specified gradation range and the gradation range provided by a commercial asphalt provider.

Table 2.1. Batch/Mix Design Specifications.

Specifications			**Actual Mix Design from Local Procured HMA**
Sieve Size		UFC Control Points (% Passing)	HMA Fine SP-12.5 (% Passing)
Inch	mm		
3/4	19.0	100	100
1/2	12.5	76 – 96	***98***
3/8	9.5	69 – 89	89
No. 4	4.75	53 – 73	70
No. 8	2.36	38 – 60	52
No. 16	1.18	26 – 48	40
No. 30	0.60	18 – 38	31
No. 50	0.30	11 – 27	17
No. 100	0.15	6 – 18	7
No. 200	0.075	3 – 6	4.8
Note: Italicized number represent values outside UFC criteria.			

2.2. Creating Asphalt Cookies. Asphalt cookies are non-compacted chunks of HMA and virgin asphalt mix components. Cookies should be created before hostilities are imminent. The following vehicles and equipment are recommended for constructing HMA cookies:

- FEL with bucket
- Hand tools: shovel (x2), scale/measuring tape
- Compact track loader (CTL) with sweeper attachment (optional)

2.2.1. **Step 1.** Designate and prepare a paved surface area by clearing any debris or objects. Use the CTL sweeper attachment to sweep the surface (optional).

2.2.2. **Step 2.** Stockpile HMA material near the designated windrow area.

2.2.3. **Step 3.** Use the FEL to pick up approximately 0.5 ton of stockpiled material and dump material at one end of the designated area for windrows.

2.2.4. **Step 4.** Place the bucket just over the dumped HMA with the bucket tilted down so the underside is almost vertical. Using a tape or scale, set the cutting edge of the bucket approximately 2.5 inches from the paved surface.

Note: Available footprint may determine the windrow height. The thinner the windrow, the better the material breaks into manageable size chunks when scraping up the windrow with the loader bucket.

2.2.5. **Step 5.** Move FEL backwards to drag, strike off, and spread the HMA and create the windrow. Use shovels to keep HMA behind the bucket as necessary.

2.2.6. **Step 6.** Repeat steps 3 thru 5 until all stockpiled material is spread into windrows.

2.2.7. **Step 7.** Let windrow material cool to ambient temperature.

2.3. Recommended Cookie Storage Technique. The preferred method of storage is to keep the HMA material placed in windrows until it is needed for use (**Figure 2.1**). When ready to begin producing HMA scrape/push windrow material to the center of the windrow. As the material is being pushed, the material breaks into cookies. Use the FEL bucket edge to break up any HMA cookie with a length or width dimension larger than 15 inches. The HMA cookies can then be stockpiled at the HMA batch plant. This storage method requires a significantly larger area for storage than stockpiling the same amount of material.

Figure 2.1. Creating Windrows.

Note: There is an inversely proportional relationship between the cookie size and production rate of the asphalt recycler. The optimum cookie size for the recycler is 2.5 inches thick and no larger than 15 inches wide by 15 inches long.

2.4. Alternate Storage Technique. If space is an issue, store cooled cookies in 20-ton stockpiles. The two major problems associated with stockpiling are consolidation and moisture retention.

2.4.1. Experience has shown that large, conical stockpiles have a tendency to form an 8 to 10 inch crust over the stockpile. This crust can be easily broken by a front end loader. Also, the crust tends to shed water and prevent the rest of the pile from consolidating.

2.4.2. The stockpile should be built on a solid surface to prevent contamination or compaction of the underlying surface. The finer particles in the processed cookies tend to absorb and retain moisture, which increases the moisture content of the material. Cookies or the production rate has to be sacrificed if there is an increase in moisture content. An increase in moisture content by even 0.5 percent will seriously hinder HMA production capabilities. Hence, proper drainage of the stockpile should be provided. Tall conical stockpiles provide better drainage compared to low, flat stockpiles. Depending on the annual moisture level in the region, use of protective coverings such as tarps or structures should be considered.

2.4.3. Check stockpiles for consolidation weekly and when consolidation becomes obvious, turn and re-pile (consolidation time varies depending on stockpile size and environmental factors).

2.5. Reclaimed Asphalt Pavement (RAP). The quality of RAP cannot be guaranteed without material testing as described in AFH 32-1034. Possible use of a rejuvenator or additional asphalt may be required when using RAP. If a need arises to use existing paved asphalt surfaces to make RAP supplies, use conventional practices and equipment for removing and breaking the asphalt paved surfaces.

2.6. Maximum Raw Material Stockpile Storage Time. Research to determine the effects of weathering and oxidation on asphalt stockpiles is currently being conducted. Findings will be included in this publication as they become available.

Chapter 3
ASPHALT PRODUCTION PROCESS

3.1. Batch Start Times. Begin the recycler warmup process when released from the shelter area after the attack (see **paragraph 3.11**) so the recyclers are ready to produce quality asphalt when needed. Warehouse 1 Lead manages the asphalt production and delivery processes. For asphalt capped repairs, the Crater Repair Team Lead informs the Warehouse 1 Lead when pavement breaking is about to commence. At this time, Warehouse 1 Lead requests the Batch Plant to begin batching operations in order to have HMA delivered to the airfield when the capping crew is ready to begin capping repairs. **Table 3.1** provides data used to help manage the asphalt production process.

Table 3.1. Asphalt Production and Consumption Rates.

Batch Plant	Hourly Prod. Rate* (tons)	Team	Hourly Consumption Rates** (tons)	Surplus / Deficit (tons/hr.)	Recommended Production Start Time	Min. Production Time (hrs.)
1	14	1	9	+ 5	2.5 hrs. after release (1 hr. before need)	2.57
1	14	2	18	- 4	1.5 hrs. after release (2 hr. before need)	5.15
2	28	3	27	+ 1	2 hrs. after release (1.5 hrs. before need)	3.85
3	42	5	45	- 3	1.5 hrs. after release (2 hr. before need)	4.28
4	56	7	63	- 7	0.5 hr. after release (3 hr. before need)	4.5

*One batch plant using two asphalt recyclers, each one capable of producing 7 tons per hour of asphalt.
**Assumes 8.5’ x 8.5’ x 4” cap @ 150 lbs/ft^3 mat density.

3.2. Tracking Production, Hold Times, and Deliveries. The Batch Team Lead keeps Warehouse 1 Lead informed of asphalt production, stockpile size and hold times. Dump truck operators inform the Warehouse 1 Lead of dump truck load and hold times, and start and finish of asphalt deliveries.

3.2.1. Maximum stockpile hold times vary, depending on environmental conditions and whether the batch plant is located indoors or outdoors. A rule of thumb is maximum stockpile hold times consistently being added to in temperate and dry weather conditions is three hours. There is no rule of thumb for cold weather conditions; stockpiles must be constantly monitored in cold weather to ensure the stockpiles are used before cooling below useable temperatures. Projects are scheduled to determine more definitive stockpile hold times and will be added to this publication when projects are complete.

3.2.2. Cover the HMA stockpile with tarps, from the inclement weather kit in the 4FWCR UTC, when temperatures are below 70°F or when crater repair delays occur to help prevent the HMA from cooling too quickly.

3.3. Overview of Recycler Operation. The described operating procedures herein maximize HMA production rate and meet specific discharge temperatures (340° F is the typical target) while operating the recycler in continuous mode using HMA cookies. The operator attempts to maintain a constant 1,015 PSI (70 bar) drum pressure during warm-up (**paragraph 3.11**) and continuous operation by monitoring the drum pressure read-out and adding material in the charging box as necessary. The unit should be operated on high heat for the majority of the warm-up period (approximately 10 minute warm-up). After the warm-up period, the operator adjusts the heat as necessary to meet the target discharge temperature. When the discharge temperature becomes relatively constant, the operator typically switches to low heat for the majority of the continuous production run.

3.3.1. If material discharge temperatures drop below specified temperature ranges, the operator switches to high heat for a short period (approximately 1-2 minutes) to increase the drum temperature and then switches back to low heat to continue production. The operator may need to cycle in and out of high heat more frequently if the RAP material has high moisture content or if the operator overloads the drum (more than 1,015 PSI [70 bar]) inadvertently or in an effort to increase the production rate.

3.3.2. Circumstances may dictate a higher target discharge temperature (i.e. 350-370°F). Two operating adjustments can be made to increase the discharge temperature. First, the operator can cycle in and out of high heat more often. Second, the operator can under-fill the drum (below 1,015 PSI [70 bar]) to increase heat transfer from the drum to the material inside the drum. A combination of these two options may be required.

3.4. Recycler Operating Tips.

3.4.1. **Do:**

- Make sure machine is properly leveled and weight is on all jacks.
- Maintain consistent load in machine to reduce smoke and overheating.
- Make sure door on drum is at the bottom position and opened when machine is idle to drain water.
- Keep rollers and chain well lubricated they are exposed to high temperatures.
- Keep drum drive chain in proper adjustment, chain and teeth will last longer.
- Keep roller path clean, rollers will last longer.
- Minimize loading of oversize chunks and rocks—the drum paddles and shell will last longer.
- Keep drum rotating and blower on during cool down at end of production.
- Keep door actuator paddles clean to avoid excessive drum door ramp wear and paddle damage.
- Keep engine RPM and generator belt tension properly adjusted to maintain correct voltage for burner system.
- Keep burner properly adjusted.
- Bleed fuel system after changing filters.
- Keep machine clean, material buildup will cause rapid wear to components.
- Turn drum while burner is firing.

3.4.2. **Do Not:**

- Run machine on extremely soft surfaces without pads under jacks as the machine can settle unevenly and cause misalignment and uneven loads on drum.
- Surge load machine.
- Run burner without drum rotating.
- Run burner without material in the drum except for initial warm-up.

- Leave material in drum at end of production, it will all fall to bottom of drum and cause excessive unbalance in drum on startup causing possible drive damage.
- Attempt to run burner without engine at full RPM, electrical component damage may result due to low voltage.
- Weld on machine without unplugging generator and disconnecting battery.
- Hit override button repeatedly (more than 3 consecutive times as it could damage fire control relay) locate the problem and correct.
- Drop material from excessive height into charging box.

3.5. Smoke Emission Indicators. Smoke from the recycler indicates some operating conditions.

3.5.1. White smoke coming out of the inlet, but dissipates within 50 feet: caused by water and is not an issue.

3.5.2. White/blue smoke out of inlet, but does not dissipate within 50 feet: Finishing area of drum is well above 350°F and is flashing A/C off material. This will be more defined if in Low Fire or Burner Off/Blower On. Adjust feed/ discharge rate of machine to control. Use shutdown steps to control. White smoke off material at discharge indicates material is overheated, should only see slight blue haze coming off material at discharge. Target 300-325°F. Also, can be result of overfilling machine and pushing material up into burner funnel bringing material in contact with flame.

3.5.3. Black smoke at burner start and during operation indicates low air volume on burner. Material buildup in fan segments cutting air volume resulting in wrong air/fuel mixture. Clean blower fan.

3.5.4. Brown/black smoke. There is a fire in the drum. Cut burner, add material to cool drum. Leave door closed five minutes then start discharging and resume operation.

3.5.5. Slight blue haze out inlet and off of material. Optimal!

3.6. Safety. Before putting the recycler into operation, familiarize yourself fully with all parts and functions of the machine and the manufacturer’s operating instructions/safety precautions (provided with the recyclers).

3.7. Setup Location. The asphalt batch plant area should be setup in an area that meets the following criteria.

3.7.1. Set recyclers up on stable ground as level as possible.

3.7.2. Leave ample space around recyclers for loading and unloading.

3.7.3. Clear the area of flammable materials.

3.7.4. Locate recyclers in an area free of overhead obstructions such as structures, overhangs, power lines, and trees.

3.7.5. Avoid operating recyclers in areas where exhaust gases could enter air handling systems for adjacent facilities.

3.7.6. Do not operate recyclers in enclosed structures without adequate overhead clearance, proper exhaust handling system and sufficient make up air to handle exhaust and requirements of engine and burner.

3.7.7. Stockpile HMA cookies (feed stockpile) near the asphalt recyclers so that the FEL operator can easily access the feed stockpile but not be hindered when retrieving HMA from both recycler discharge areas. Spacing/dimensions in **Figure 1.1** are examples and may not be the same for all locations. It is the FEL operator's discretion how much space is necessary between the stockpiles and the asphalt recycler equipment.

3.8. Recycler Setup Procedures.

3.8.1. After positioning recycler, set parking brake and chock wheels before disconnecting from tow vehicle.

Note. If setting up on very soft (i.e. loose dirt) surface, place mats under supports to help keep the recyclers from sinking and becoming out of level on soft ground. Setting recyclers on asphalt surfaces works the best.

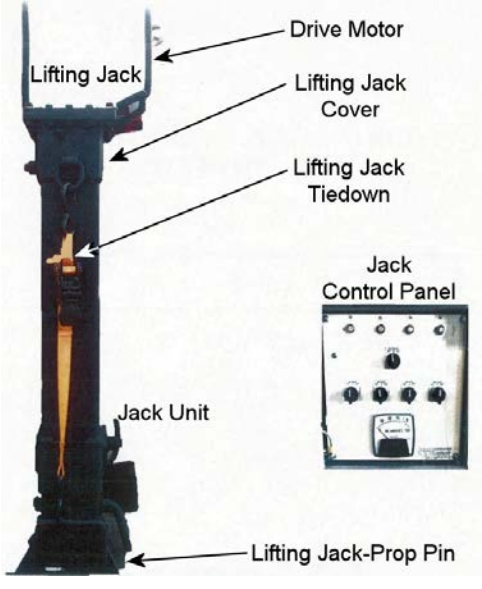
3.8.2. Unlock manual locks and lower drop legs and pins (**Figure 3.1**).

3.8.3. Operate jack control (**Figure 3.1**) to raise the recycler to operating height. Do **NOT** operate jack actuators with manual locks engaged. Adjust all four corners to level the unit.

3.8.4. Tighten manual locks.

3.8.5. Spray down the throat, backstop, and discharge gate mechanism with release agent.

Figure 3.1. Four Corner Jacking System.



3.9. Pre-Operational Checks.

3.9.1. Inspect all engine fluid levels.

3.9.2. Check hydraulic oil level (bottom quarter of sight glass when cold).

3.9.3. Inspect engine and generator belts for condition and correct tension.

3.9.4. Inspect burner filters.

3.9.5. Lubricate rollers and drive chain.

3.10. Start Up Process.

Note. If below 32°F, use extension cord in toolbox and connect to receptacle on front panel of machine and 120VAC power source and allow minimum of 5 minutes to warm fluids and battery.

3.10.1. **Step 1.** Remove hydraulic control umbilical (**Figure 1.5**) from toolbox to connect to right side (R/S) or left side (L/S) of recycler as required. Set control switch in engine compartment to correspond with side chosen for operation (right or left). Make sure all umbilical switches are in off position.

3.10.2. **Step 2.** Remove infrared control head (**Figure 3.2**) from toolbox and position on desired side of machine and connect wiring accordingly.

Figure 3.2. Infrared Control Head.

3.10.3. **Step 3.** Start engine and allow to warm and stabilize at idle (if below 60°F, turn on 12VDC fuel heater).

3.10.4. **Step 4.** Turn on master switches to enable hydraulics and infrared thermometers to monitor discharge temperature.

3.10.5. **Step 5.** Engage drum to aid in warming up hydraulic system.

3.10.6. **Step 6.** Remove ratchet and socket from toolbox for jack manual locks and loosen all jack locks.

3.10.7. **Step 7.** Lower dropdown sections of elevation jacks to last pin hole. Install support pins and safety pins.

Note. It may be required that you lower the front of machine by lowering propping jacks to get pins in for rear drop legs. Then raise the front of machine to set front drop legs.

3.10.8. **Step 8.** Bring engine to full throttle with drum drive engaged.

3.10.9. **Step 9.** Open jack control box and use the ALL JACKS LOWER switch to extend all jacks at the same time. Raise machine to end of jack stroke. The amp gauge will jump up when the first jack reaches the end. The breaker for that jack will pop if switch is maintained...if breaker pops, reset.

3.10.10. **Step 10.** Use individual switches (**Figure 3.1**) to level machine by referencing the dual axis level to the lower right of jack control box.

3.10.11. **Step 11.** When machine level has been achieved, tighten all elevation jack manual locks with ratchet and socket provided.

3.10.12. **Step 12.** Lower manual backstops for backboard down to 4th hole and secure.

3.10.13. **Step 13.** With aid of the mini-chain fall in the toolbox, first raise the backboard to remove transport chains. Connect hooks to loop on back of board to stow them. Using chain fall, lower the backboard to ground and unfold extensions.

3.10.14. **Step 14.** Lower and pin ladder assembly.

3.10.15. **Step 15.** Open burner control panel and move step switch to Position #1. Confirm fuel suction and pressure values are correct.

3.10.16. **Step 16.** Confirm display is correct. Clean drum temperature sensor window if required.

Note. Drum temperature display will start to read low as the window gets dirty. Clean with a soft rag, wetted with some fuel oil.

3.10.17. **Step 17.** Operate umbilical to verify all functions:

- Drum forward and reverse with detent in forward position
- Hopper up and down with detent in lower position
- Drum high speed; engage and disengage

Note. Never reverse drum or open door while in high speed

- Open door and operate drum reverse direction - hold door switch in open position. When drum stalls, release door switch. Engage drum in forward position (detented).
- Close Door and operate drum in normal forward direction (detented). Move door switch to closed position. When drum stalls, release door switch. Reverse Drum one (1) rotation and then back to forward or detented position.

3.10.18. You are now ready for operation. Ensure a sufficient quantity of material is on-hand for desired production before lighting burner.

3.11. Warmup Process. The warmup process is a multi-step process to run asphalt cookies or RAP through the asphalt recycler to produce HMA at the correct temperature.

3.11.1. **Step 1.** Move burner control switch to Position #2. Burner should light at 8-second mark. Run burner in Position 2 (low fire) approximately two (2) minutes depending on ambient temperature (up to five (5) minutes in extreme cold).

3.11.2. **Step 2.** Fill hopper (**Figure 3.3**) and load drum with light load (approximately 725 psi [50 bar]). Leave in "Low Fire" for five (5) minutes.

Figure 3.3. Loading Asphalt Recycler.

3.11.3. **Step 3.** Move burner control to Position #3. Continue with door closed (approximately three minutes).

3.11.4. **Step 4.** Open door. The first couple of drops may not be turned yet. Monitor temperature. If not above 250°F by fifth (5th) drop, close door and move burner switch back to Position #2. Wait approximately three (3) minutes. Then open door and check temperature of the discharge material. It should be approaching 300°F at this time. Leave the door open and return step switch to Position #3 (High Fire). Maintain drum load at about 725 psi (50 bar) by using small dumps out of the hopper. As the drum gains temperature, you will need to increase drum load to a maximum of 1015 psi (70 bar) to control discharge temperature. Do not exceed 1015 psi (70 bar) at any time. If unable to control discharge temperature at 1015 psi (70 bar), switch back to low fire.

3.11.5. If the HMA discharge temperature is within or above the specified temperature range, continue discharging HMA. Lowering the burner setting and/or loading more material into the drum will reduce the temperature of the material in the drum which in turn lowers the discharged HMA temperature.

3.11.6. If the HMA discharge temperature is below the specified temperature range, close the discharge gate and continue to heat and mix the material.

3.11.7. It is common for material discharge temperatures to rise or fall a few degrees before normalizing and leveling out. If the initial discharged material

temperature is slightly below the specified range, discharge HMA for 30 seconds to allow the temperature to rise into the acceptable range. If temperature does not rise into the acceptable range, close the discharge gate.

3.11.10. **Step 5.** Repeat Steps 3 and 4 until the HMA discharge temperature is within the desired range. The burner switch may have to be switched between setting 2 (burner stage 1) and 3 (burner stage 2) to maintain a discharge temperature within the specified temperature range.

3.11.11. **Step 6.** Once the warm-up period is complete (material temperature has stabilized), place asphalt produced during the warmup period back in the feed stockpile to be rerun and used for repairs if it has not been overheated (above 380°F). Dispose the asphalt produced during the warmup period if it was overheated.

Note: If the plant is on semi-improved surfaces, use the asphalt produced during warmup as a bed for the stockpiled material.

3.12. HMA Production. Remove HMA material under the discharge gate as needed and load in dump trucks or transport to storage using a front end loader with a bucket.

Note: Early in the production process, maintain temperatures in the higher part of the desired range (350 - 380°F) to help ensure proper stockpile temperatures. As asphalt production nears 50 percent of the required production, gradually bring the temperature down to the lower part of the range (290 - 310°F) to decrease time required to cool repairs.

3.12.1. During asphalt production, the operator should ensure the pressure ratings are maintained between 900-1,000 pounds per square inch (60-70 bar). If the drum pressure drops, the temperature will begin to rise in the drum affecting quality of the asphalt. If the drum pressure is too high, temperature will begin to drop lowering its effect on the consistency of the asphalt.

3.12.2. Maintain a consistent drum pressure by monitoring the intake and production of material. Making the drum lighter or heavier as needed to maintain a consistent temperature.

3.12.3. During batching operation the asphalt recycler can become jammed or clogged with debris. The recycler operator removes any debris or asphalt clumps within the recycler to ensure the proper operation. Perform the following actions to help prevent buildups, clogs, and jams:

- Check throat area periodically for obstructions. Blockage in this area causes rapid overheating of material in the drum due to reduced airflow.
- In extreme cases, a pry bar may be used to remove buildup of asphalt lumps at the charging box/tumbler chute entrance.
- For large chunks, reverse drum direction for approximately one minute and pull chunk materials back into production area of the drum to reheat.
- Between production runs, check for any buildup of materials at the charging box/tumbler chute entrance.

Note: Stockpiles should be covered with tarps and a berm constructed around the stockpiles during inclement weather. Tarps and berm material are included in the Inclement Weather Kit from UTC 4F9CR.

Note: Tests in temperate and dry weather suggests 10 tons of asphalt can be held in a 10-ton dump truck no longer than 3 hours. Asphalt may cool below minimum placement temperature of 270°F if held beyond 3 hours.

3.12.4. When enough HMA has been produced, cease loading the hopper, but continue dumping hopper contents into the drum until empty. Do not over load the drum (exceed 1,015 PSI [70 bar]). Raise the loading tray fully and continue producing asphalt.

3.12.5. Monitor the drum temperature and reduce the burner stage accordingly as material moves through the drum and out the discharge gate.

3.13. Work Interruption. Perform the following actions if there is an interruption in the HMA production process.

3.13.1. If the work is to be interrupted for up to thirty minutes, discharge the tumbler to one third or half of its contents, close the discharge gate, keep the tumbler turning and switch burner to position "0".

3.13.2. If the work is to be interrupted for more than 30 minutes, discharge the tumbler completely and switch off burner and engine.

3.13.3. At continuous operation keep the contents of the tumbler at a level corresponding to 1,015 PSI (70 bar) on the hydraulic oil pressure gauge, keep burner operation at maximum rate and discharge the reprocessed asphalt continuously.

3.13.4. Fill asphalt lumps into the recycler until the reading of the hydraulic oil pressure gauge is 1,015 PSI (70 bar) and 870 PSI (60 bar) when using asphalt fines (material passing through a #4 sieve [4.75-mm]).

3.14. Shut Down.

3.14.1. **Step 1.** Perform an end-of-production run to clean the recycler and to ensure it is ready for its next mission (see **paragraph 4.2**).

3.14.2. **Step 2.** Unlock all manual locks on elevation jacks. Lower front of unit to free up backboard. Clean and raise backboard and secure. Raise all elevation jacks completely and secure all manual locks.

3.14.3. **Step 3.** Idle engine down and shut off all control switches. Allow engine to cool two (2) minutes and shut down.

3.14.4. **Step 4.** Stow all gear.

3.15. Batching Complete. Batch Plant Team Lead informs the Logistics Chief when personnel have finished their tasks and are idle so they may be loaned to other teams as necessary.

Chapter 4
RECYCLER CLEANING

4.1. During Production Run. Check for material buildup between production runs at the charging box/ tumbler chute entrance. If major build-up occurs, use crowbar and hand tools (chisel, hammer-drill, hammer, etc.) to remove material buildup. Machine must be totally cooled and not in operation (OFF) before removing any buildup inside these areas.

4.2. End of Production Run.

4.2.1. **Step 1.** Close the discharge gate and keep the contents tumbling for five minutes at the first burner firing stage to ensure all the asphalt lumps are thoroughly heated.

4.2.2. **Step 2.** Fully open discharge gate to discharge material in the tumbler.

4.2.3. **Step 3.** Switch the burner to stage 1 (burner fan still blowing, no heat).

4.2.4. **Step 4.** With the aid of the leveling jacks, lower the discharge end of the recycler to ensure complete discharge of the contents.

4.2.5. **Step 5.** Fully open the discharge gate (manually) to remove any bigger chunks of material trapped in the tumbler.

4.2.6. **Step 6.** While the engine is still running and the burner fan blowing, spray the gate, gate tracks, and drum channel with asphalt release agent to ensure all asphalt has been removed.

4.2.7. **Step 7.** Leave the engine running and the burner fan blowing (burner switch in stage 1) until the tumbler has cooled below 120°F (50°C).

4.2.8. **Step 8.** Close the discharge gate.

4.2.9. **Step 9.** Stop the tumbler drive with the discharge gate at the bottom of the drum open.

4.2.10. **Step 10.** Turn the burner switch to stage 0 (everything off) and turn off the recycler engine.

4.2.11. **Step 11.** Clean caked or stray asphalt off the recycler.

4.2.12. **Step 12.** Clean up the area surrounding the recycler.

4.2.13. **Step 13.** Wash down the throat area, discharge gate, and backstop with release agent.

Chapter 5
Asphalt Recycler Maintenance Requirements

5.1. Daily:

- Check engine oil, water, and air filter restriction.
- Check engine and generator drive belt tension.
- Check hydraulic oil level.
- Check fuel filters.
- Check and lubricate all rollers and drive chain. (10 shots rollers, keep chain wet).
- Check that all burner components are secure.
- Check burner for fuel leaks.

5.2. Monthly:

- All items on Daily list.
- Clean roller paths and roller pockets.
- Check drum drive chain tension and adjust if necessary.

Note. Adjusting chain tension should be accomplished by an experienced operator. Improper tension will cause damage to drum chain, drum drive components, and/or drum teeth.

- Clean burner primary fuel screen and inspect secondary filters.
- Check drum end clearance and adjust if required.
- Lubricate charging box cylinder pins.
- Clean all tank breathers.
- If stationary, rotate wheels to keep from damaging bearings.

5.3. Annually:

- All items on Daily and Monthly list.
- Change hydraulic oil and filter.
- Inspect drive chain, drum teeth, drive sprocket and idler.
- Inspect all carry, side and thrust rollers.
- Inspect drum inlet area and drum for wear.
- Inspect drum door and actuators for wear and buildup as required.

- Clean and inspect burner, replace nozzles, reset electrode gap.
- Clean valley of blower vanes, air box and damper door. As they fill with debris air volume drops and burner falls out of adjustment. More frequently if operated in very dusty environment.

5.4. Engine Service and Burner Fuel Filters. 250 hours normal service, 200 hours severe conditions.

5.5. Hydraulic System Oil and Filter. 1000 hours/1 Year.

5.6. Burner Malfunction and Troubleshooting. In case of a burner malfunction do not try to re-start the burner by pushing the reset button more than three times. Too many re-starts which fail again may cause the burner relay to become overloaded and fail completely. It is advisable to solve the problem by systematic study and following the trouble shooting diagram in the Operators' Manual.

Chapter 6
RECONSTITUTION AND RETURN TO NORMAL OPERATIONS

6.1. Overview. This phase begins when directed to return to normal operations. During this phase, begin implementing plans to reconstitute the RADR equipment, materials, and vehicles and then resume normal operations. Supervise an orderly return to the normal operating facilities, or movement to a temporary or permanent facility. Maintain communication with command and control (C2) agencies during transition and report mission manpower and capability.

6.2. Reconstitution. When directed, begin the following reconstitution actions:

- Replenish virgin asphalt/rap stockpiles.
- Perform vehicle post operational inspections and take appropriate action for any discrepancies found.
- Clean recyclers.
- Refuel recyclers and vehicles.
- Return vehicles to their duty locations or staging areas.

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Attachment 1
GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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Abbreviations and Acronyms

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFRIMS—Air Force Records Information Management System

BEEF—Base Engineer Emergency Force

C2—command and control

CTL—compact track loader

FOD—foreign object debris

OIC—Officer in Charge

OPR—Office of Primary Responsibility

RADR—Rapid Airfield Damage Repair

RAP—reclaimed asphalt pavement

RDS—Records Disposition Schedule

TTP—tactics, techniques, and procedures

UFC—Unified Facilities Criteria

UTC—Unit Type Code

Terms

Airfield—An area prepared for the accommodation (including any buildings, installations, and equipment), landing, and takeoff of aircraft.

Crater—Craters represent damage that penetrates through the pavement surface into the underlying base and sub grade soil, which uplifts the surrounding pavement and ejects base, sub base soils, rock, and pavement debris around the impact area. Large craters have an apparent diameter equal to or greater than 6 m (20 ft). Small craters have an apparent diameter less than 6 m (20 ft).

Debris—Material ejected from the crater including broken pavement and soil. Debris is some-times usable as backfill material particularly for large crater repair, but for small crater or spall repair it is generally not advisable.

Facility—A real property entity consisting of one or more of the following: a building, a structure, a utility system, pavement, and underlying land.

Minimum Airfield Operating Surface (MAOS)—The combined requirement for airfield surfaces for both runway and access routes. The MOS is part of the MAOS.

Minimum Operating Strip (MOS)—1. A runway which meets the minimum requirements for operating assigned and/or allocated aircraft types on a particular airfield at maximum or combat gross weight. 2. The MOS is the smallest area to be repaired to launch and/or recover aircraft after an attack. Selection depends upon mission requirements, taxi access, resources available, and estimated time to repair. For fighter aircraft, the typically accepted dimensions are 5,000 feet long by 50 feet wide.

Mission—1. The task, together with the purpose, that clearly indicates the action to be taken and the reason therefore. 2. In common usage, especially when applied to lower military units, a duty assigned to an individual or unit; a task. 3. The dispatching of one or more aircraft to accomplish one particular task. (JP 1-02)

Personnel—Those individuals required in either a military or civilian capacity to accomplish the assigned mission.

Procedures—Standard, detailed steps that prescribe how to perform specific tasks.

Recovery—The development, coordination, and execution of service- and site-restoration plans for impacted communities and the reconstitution of government operations and services through individual, private-sector, nongovernmental, and public assistance programs that: identify needs and define resources; provide housing and promote restoration; address long-term care and treatment of affected persons; implement additional measures for community restoration; incorporate mitigation measures and techniques, as feasible; evaluate the incident to identify lessons learned; and develop initiatives to mitigate the effects of future incidents.

Runway—A defined rectangular area of an airfield, prepared for the landing and takeoff of aircraft along its length. A runway is measured from the outer edge of the thresholds from one end of the runway to the others. The width of the runway is typically measured from the outer edge of the load-bearing pavement on one side to the outer edge of the load-bearing pavement on the other side. In some cases the runway may be measured from the outside edge of the runway marking line on one side to the outside edge of the marking line on the other side and any remaining load bearing pavement is considered shoulder.

Spall—Pavement damage that does not penetrate through the pavement surface to the underlying soil layers. A spall damage area could be up to 1.5 meters (5 feet) in diameter.

Support—1. The action of a force that aids, protects, complements, or sustains another force in accordance with a directive requiring such action. 2. A unit that helps another unit in battle. 3. An element of a command that assists, protects, or supplies other forces in combat. (JP 1-02)

Tactics—1. The employment of units in combat. 2. The ordered arrangement and maneuver of units in relation to each other and/or to the enemy in order to use their full potentialities. (JP 1-02)

Techniques—Non-prescriptive ways or methods use to perform missions, functions, or tasks.

Threat—An indication of possible violence, harm, or danger.