

## Infrared Asphalt Recycling Equipment Procedure and Training Outline

The KM International Team would like to take this opportunity to thank you for your purchase of KM asphalt maintenance equipment. We are confident that your new KM equipment will provide years of productive service and become an integral component in your road and parking area maintenance fleet.

KM International, Inc. has acquired and developed a number of strengths that has fostered our worldwide reputation in the asphalt maintenance industry as the “Gold” and “Green” standards. We are the preeminent authority on the “infrared process” of in-place “surface heating” and “recycle and repair.” We have fostered an ongoing industry standard of quality and excellence that continually exceeds our customers’ expectations in all of our product offerings including our Infrared Asphalt Recyclers and Asphalt Hotbox Reclaimers.

The Goal at KM INTERNATIONAL has, and will always be, the manufacture of smartly designed and quality manufactured equipment that provide our customers cost savings, purchase justification and profitability.

Nothing can replace practical application and field experience. The following pages provide a brief guideline to help you get started and as a reference in the future. We recommend that you develop a strategy that best suits your business plan. Remember, safety is always considered the number one daily priority. Only trained personnel should be authorized to use this or any equipment. Consult equipment manuals for more specific use and maintenance procedures. A KM International team member is always willing to offer their best practice advice should a question arise.



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## **KM International Infrared Asphalt Recycling Equipment and Procedure Training**

### Outline

#### I. Infrared Radiation: Heating Asphalt Pavement

- A. Radiant energy/Infrared radiation - Invisible transfer of energy (wavelengths)
  - 1. Convection - Air circulation & diffusion
  - 2. Conduction - Through a solid material
- B. Absorbing energy into asphalt pavement - infrared patching
- C. Absorbing energy into asphalt - hotbox heating
  - 1. Maintaining asphalt temperatures
  - 2. Reclaiming stockpiled asphalt

#### II. Equipment - Infrared Asphalt Recycler

- A. KM 4-40, KM 4-48, KM 2-18X, LB 2-16, Custom
  - 1. Understand the units operating features, controls and fundamentals.
  - 2. Review the heating system. On/Off cycling.
  - 3. Blanket - How it heats. How to maintain it.
  - 4. Blanket replacement & adjusting zones.
- B. Maintenance
  - 1. Charge Battery - daily
  - 2. Clean & grease casters - daily
  - 3. Inspect stainless hardware - daily
  - 4. Inspect & clean pilot/spark plug - daily
  - 5. Inspect infrared in shop - monthly
- C. Safety
  - 1. Propane - Securing on unit. Storage. Transfer on vehicles.
  - 2. Inspect fuel lines.
  - 3. Heat escaping around perimeter of unit.

### III. Equipment - Asphalt Hotboxes

- A. KM 4000SXPX, KM 8000SXPX, KM Propane Heated Trailer Units
  - 1. Changeover regulator
  - 2. Lighting the burner
  - 3. Setting the thermostat - Recommended temperature settings.
- B. Loading asphalt
  - 1. Asphalt plant
  - 2. Loading stockpiled mix
- C. Maintenance
  - 1. Cleaning the interior - Never use a flammable solvent
  - 2. Keep vents clean
  - 3. Longterm storage - clean pilot orifice & pilot line
  - 4. Venturi inspection & adjusting (if necessary)

### IV. Asphalt Repair

- A. Equipment & Tool List - "KM Infrared Asphalt Recycling Checklist"
- B. Procedures - "Asphalt Repair Using Infrared Asphalt Recycling Equipment"
- C. Complete a repair
  - 1. Unload equipment
  - 2. Heat
  - 3. Rake
  - 4. Rejuvenate
  - 5. Shovel
  - 6. Lute
  - 7. Compact
  - 8. Rejuvenate
  - 9. Clean up

### V. Certificate

## Infrared Radiation: Heating Asphalt Pavement

KM International's In-Place Recycling equipment (i.e. Infrared Asphalt Recycler(s)) use a mixture of atmospheric air and vapor withdraw propane gas to produce the **radiant energy** necessary for softening pavement without damaging the pavement and asphalt binder, such as an open flame energy will.

**Radiant energy**, also referred to as **infrared radiation** within the industry, is a means of heat transfer from the heat source (KM infrared equipment) to the heated object (asphalt pavement).

**Infrared** by definition meaning the part of the invisible light spectrum that is contiguous to the red end of the visible spectrum of wavelengths from 0.8 - 1000 microns.

**Radiation** by definition meaning the process in which energy is emitted as particles or waves.

**Infrared Radiation:** The invisible transfer of energy.

- Attached below is a description from the manual for the KM 4-48 Infrared Asphalt Recycler.

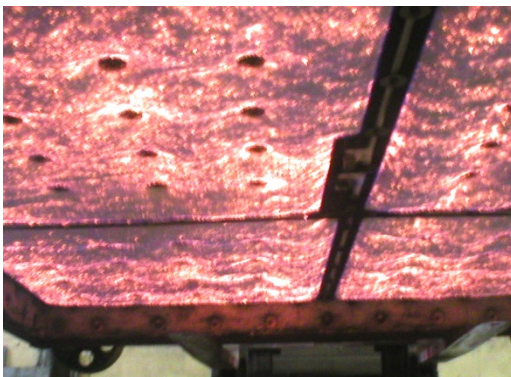


Figure 1



Figure 2

### **HOW the HEATING SYSTEM WORKS**

The blower constantly forces air through the micro-spaces in the ceramic refractory fiber blanket. When the control valves are opened, propane gas is mixed with this air. The pilot light then ignites as shown in *Figure 2*. This results in the combustible mixture, at the lower surface of the blanket, to ignite on the surface of the ceramic blanket as shown in *Figure 1*. Flame is never present behind the blanket. The flame spreads evenly across this lower surface and quickly turns red-orange hot. The long wave radiant energy or Infrared that is developed then penetrates the asphalt surface. The KMI Infrared heating process is the only one of its kind in the industry. The heater utilizes automatically timed cycles that turn the heater on and off during use. The process was specifically designed by the KMI Team to allow for deeper penetration of the asphalt without burning or scorching the surface. The KM International Infrared Process allows the heated asphalt to be reused and provides a better longer lasting seamless repair. **WARNING: Heat escaping from under the KM 4-48 Infrared causes the bottom sides of the unit to get very hot. Be sure that the blower has gone through its final cooling cycle. Depending on ambient conditions, the heaters may still be hot enough to cause serious injury. SHOW CARE & CAUTION when loading and transporting.**

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## KM Infrared Asphalt Recycling Checklist

Use this form as a daily reminder of the basic tools and requirements to help perform asphalt maintenance and repairs using KM Infrared and Hotbox equipment. As with any quality driven professional, the list will modify in detail and grow in equipment & tools with experience and attention to detail.

Equipment	Infrared Unit	Propane on equipment	Extra propane if necessary	Wind skirts
	Hotbox	Propane on box	Extra propane if necessary	Asphalt in box
	Plate compactor	Water in compactor	Gas in compactor	Extra water
	Blower	Gas in blower	Extra 2 cycle gas	
	Roller (optional)	Water in roller	Gas in roller	Extra water/hose
Tools	Asphalt Rake (2)	Lute (1)	Flat Shovels (2)	Broom
	Buckets (2)	Putty Knife	Cleaning solvent	Cones
	Hand tools	7/8" Wrench	Chalk Box	
Optional Tools	Pick Axe	Spade Shovels (2)	Cement drag	
	Tack coat	Tack brush		
Safety	Inspect for travel	Tires, hitch, chains	Tie downs & binders	Secure propane cylinders
	Inspect fuel lines			
Job Details	Jobsite location	Jobsite contact	Map to jobsite	
	Number of repairs	Unusual Repairs	Extra tools needed	
	Est. Asphalt required	Asphalt plant location & number		

### Asphalt Repair Using Infrared Asphalt Recycling Equipment

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Once the bituminous surface has been softened the process of repairing, decorating, adhering thermoplastics, or otherwise manipulating the pavement in a quality manner is considered craftsmanship. It is imperative that the operator and/or service crew be properly trained in the fundamentals of in-place reheating asphalt and asphalt repair. Much like a quality asphalt paving operator gains knowledge by experience, a quality asphalt repair technician improves craftsmanship with experience. Hands-on operation in a variety of settings will best train personnel in the craft.

Below is a "basic" step by step fundamental process for in-place asphalt repair using an Infrared Asphalt Recycler and Asphalt Hotbox Reclaimer.

1. Clean the area to be repaired. Remove all dirt, foreign debris, standing water and loose aggregate.
2. Position the infrared unit over the area to be repaired. Maintain a minimum 3" perimeter larger than the actual repair.
3. Allow the infrared heating unit to properly soften the pavement to a depth of 1.5" - 2.5". (Approx time 8-10 mins.)
4. Move the heating unit off of the repair area. Reposition for the next repair when necessary.
5. Scarify (rake) the entire minimum heated depth of the repair area. Note: Frame edges first for an attractive repair.
6. Optional: Remove material if necessary (high spots). Remove contaminated material.
7. Rejuvenate, maltenes rejuvenator, the heated and raked asphalt. Rejuvenate the heated and un-scarified edges (.12 gal/sq).
8. Add new asphalt as required per job conditions.
9. Lute the repair area level. Typical practice leaves the repair area 1/4" above surrounding grade before compaction.
10. Compact the repair.
11. Apply maltenes rejuvenator (.12 gal/sq yd) over the entire repair area. Apply stone dust and compact or broom into area.
12. Clean up repair area and surrounding area.
13. Open repair to straight drive over traffic. Allow sufficient cool down where vehicle stopping or turning is present.

Every repair requires on site evaluation and proper techniques. The infrared asphalt recycler is a tool that provides the means to service asphalt in a variety of settings including:

Pothole repair	Water drainage	Trip hazard repair
Paving seam corrections	Speed-bump installation	Pavement imprinting
Oil spot removal	Thermo-plastic installation	Utility joint maintenance

Pavement professionals utilize in-place reheating methods daily adding to the list of places and situations.