

# Criteria for Assessment of Recyclable of Component of Construction Equipment and Actions for Improvement of Recycling

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Japan Construction Equipment Manufacturers Association (CEMA)

This manual is intended for use in evaluating the recyclable of components of ordinary construction equipment manufactured at present.

In the calculation of the recyclable, however, it is not necessarily required to conform to the specification of this manual if the construction equipment incorporates unique materials and structure available for use of specific recycling technology or if there is a clear prospect of future development of recycling technology. The manual also includes our recommendations and suggestions for facilitating the recycling that could be used for technological development and improvement.

## Assessment indicator for recycling

- (1) Ease of disassembly: Can be dismantled from the equipment with ease.
- (2) Ease of separation: Can be separated into each material with ease.
- (3) Ease of identification: The material name is identifiable.
- (4) Ease of reuse: Refer to the criteria for assessment of recyclable listed on the right

## (4) Criteria for assessment of recyclable

- A. The Mrc and Trc technology has been established (Recyclable)
- B. The Mrc technology has been substantiated (Recyclable)
- C. The Trc technology has been substantiated (Recyclable)
- D. No recycling technology developed or difficulty in recycling (Not recyclable)

Category	Component	Assessment indicator for recycling							Treatment method of component, recycling technology, problems in recycling for component	Technology required for facilitation and realization of recycling/recommendations for improvement	
		(1) Ease of disassembly	(2) Ease of separation	(3) Ease of identification	(4) Criteria for assessment of recyclable						
			A	B	C	D					
Metal parts	Structure element parts	Iron parts								- After being dismantled by a dismantler, these parts are cut, smashed and loaded into electric furnace by a scrapper and reused as scrap materials - Standard applicable for iron scrap materials applied (size, quality) JIS G2401 - Mixing of paint and small amounts of oil is permissible	- It is desirable to separate special steel from ordinary steel. Special steel alone can be sold at higher price  - Method for opening sealed parts (To prevent explosion when loaded into a furnace) - A dismantling manual for construction equipment is needed
		1) Larger structure such as Boom, Arm, Frame, etc. 2) Thin steel plate parts such as Cover, Hood, Case, etc. 3) Heat treated parts such as Shaft, Bolt etc. 4) Undercarriage parts such as Link, Shoe, Roller etc. 5) Consumables such as Cutting edge, End bit etc. 6) Small parts such as Tube, Rod, Bracket, etc. 7) Hydraulic cylinder (tube) etc. 8) Wire rope 9) Casting parts (Hydraulic valve etc.) 10) Ball bearing, Roller bearing									
		Nonferrous parts								- If separated as single metal, they can be sold as scrap materials at higher price	- Structure and technology to enable separation into single metal
		Compound metal		×						- If in a small amount, they can be loaded into an electric furnace as is and recycled as steel materials for construction. Engines, transmissions and hydraulic pumps can be loaded into the electric	- To enhance a scrap value, technology for separating compound metals or the use of single metal for a part are required (The use of copper, chrome, nickel, lead and tin is avoided for steel production)
Cooler (Radiator, oil cooler, aftercooler)	Core/tank integral type	Made of all aluminum/all copper								- Reused as aluminum and copper scrap	
		Core/tank of compound type of copper, iron, stainless steel, etc.		×						- Being lead-soldered or silver/copper-brazed, they cannot be separated. The percentage of iron is small as a whole	- Structure and technology to enable separation into single metal - Promote the use of parts made of aluminum
	Core/tank divided type (Assembly type)	Core made of all aluminum/all copper								- Reused as aluminum and copper scrap	
		Compound type of core of copper, iron, stainless steel, etc.		×							- Being lead-soldered or silver/copper-brazed, they cannot be separated. The percentage of iron is small as a whole

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	Resin tank (FRTP)								- Refer to the description for resin parts	- Promote the use of integral type (tank/core)
	Iron tank/stay								- Reused as iron scrap	
Oils & Lubricant	Engine oil, hydraulic oil								- Reused as recycled heavy oil (Thermal recycle)	
	Cooling water (LLC)								- Reused after reconditioned by LLC recycle system	
	Fuel								- Reused after being drained from tank	
	Grease								- Difficult to collect because of too small amount - Used as energy source for cement furnace in some cases	
	Window washer fluid								- Collected and reused	
Filter element	Oil/fuel F.E (Including cartridge type) Air filter element		x						- Discarded	- Development of filter in which filter element alone is replaceable (Low-cost filter element)
Rubber hose	Rubber with cap Hose		x	x					- Discarded	- Structure in which a cap and hose are separable/separation technique - Development of hose having a cap reusable
Rubber shoe	Integral/separate type Rubber shoe		x						- Can be loaded into electric furnace after cutting. Iron parts are reused as iron materials, rubber parts as energy source	- Increase of electric furnace agents and established route for collection and treatment are required
Tire	Large Off-road tire for construction equi								- Used as energy source for cement manufacturing after cutting.  - There is no remold agent in Japan. - Good tires can be exported as used tires in some cases.	- The process specified in the left column has been established as the recycling process for automobile tires. The same process can be used for the treatment of large tires for construction use. - Labor-saving technology for cutting - Low-cost remold technology
Counterweight	Canned counterweight								- Crushed by crusher of hydraulic shovel. Iron parts are reused as iron scrap. Packing is reused for material of counterweight after being crushed by self-running breaker.	- Structure to facilitate dismantling (By the use of a crusher of a hydraulic shovel) - Restriction on the packing contents (Large iron mass damages a breaker) - Packing contents should be indicated (On the counterweight) - Established route for collection and treatment are required
	Cast iron counterweight								- After being broken, reused as iron scrap (It must be broken to a size loadable into electric furnace.)	- Structure to facilitate breakage (to provide a slit for breakage in casting)
Resin	Small parts			x					- Discarded because it makes up small portion and material is not identifiable.	

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Thermosetting parts	Large parts such as Floor frame, Grill, Engine hood, etc.							<ul style="list-style-type: none"> <li>- Made of materials like DCPD (dicyclopentadiene), etc.</li> <li>- Used for energy source for cement and iron manufacturing</li> <li>- Those incorporating attaching metal parts can not be recycled because metal parts cannot be removed</li> </ul>	<ul style="list-style-type: none"> <li>- Structure to facilitate disassembly and separation</li> <li>- To stop using metal parts or facilitate the separation of metal parts</li> <li>- To promote the use of thermoplastic resin available for material recycling</li> </ul>	
	Thermoplastic parts	Canopy roof Cab interior parts Meter panel, Meter cluster Housing Resin tank						<ul style="list-style-type: none"> <li>- Made of PP (polypropylene), PE (polyethylene), etc.</li> <li>- Those incorporating attaching metal parts can not be recycled because metal parts cannot be removed</li> </ul>	<ul style="list-style-type: none"> <li>- Structure to facilitate disassembly and separation of them</li> </ul>	
	Glass fiber reinforced material(Thermosetting)	Canopy roof Grill						<ul style="list-style-type: none"> <li>- Made of materials like FRP, etc.</li> <li>- Fiber and resin are inseparable (Fiber poses problems in thermal recycling)</li> </ul>	<ul style="list-style-type: none"> <li>- To stop using these materials</li> </ul>	
	Glass fiber reinforced material (Thermoplastic)	Radiator tank Radiator cowl						<ul style="list-style-type: none"> <li>- Made of FRTP etc.</li> <li>- Difficult to recycle because of the presence of fiber</li> <li>- The recycling method is under</li> </ul>	<ul style="list-style-type: none"> <li>- Study materials appropriate for recycling by continued investigation</li> </ul>	
								<ul style="list-style-type: none"> <li>- Difficult to recycle because of the use of various materials</li> </ul>	<ul style="list-style-type: none"> <li>- Limit materials or use the same material for resin parts</li> </ul>	
Electric component	Wire harness		x					<ul style="list-style-type: none"> <li>- Parts that are difficult to separate from the body are mostly discarded</li> <li>- Copper is recovered from parts separated from the body and reused as copper scrap</li> </ul>	<ul style="list-style-type: none"> <li>- Structure to facilitate separation from the body</li> <li>- Technology to facilitate separation of copper wires from sheathing</li> </ul>	
	Measuring instrument, Sensor, Controller (Including a board)		x	x				<ul style="list-style-type: none"> <li>- Discarded</li> <li>- Parts of a value may be sometimes recovered</li> <li>- Hazardous substance, if any, is difficult to remove</li> </ul>	<ul style="list-style-type: none"> <li>- Prohibit the use of hazardous substances or develop a method for removing them</li> </ul>	
	Starter, Alternator		x					<ul style="list-style-type: none"> <li>- Loaded into an electric furnace as is or separated for use as copper and iron scrap</li> </ul>	<ul style="list-style-type: none"> <li>- Structure and technology to facilitate separation into single element metal</li> </ul>	
Battery	Lead battery							<ul style="list-style-type: none"> <li>- Reused as recycled lead and recycled resin</li> </ul>	<ul style="list-style-type: none"> <li>- The treatment route has been established by battery manufacturers</li> </ul>	
Glass	Cab glass	Bonded glass	x					<ul style="list-style-type: none"> <li>- Mostly discarded because of difficulty in separation</li> </ul>		
		Glass fitted with S rubber						<ul style="list-style-type: none"> <li>- Mostly discarded because of too small amount for recycling</li> </ul>	<ul style="list-style-type: none"> <li>- Technology to facilitate separation of glass from film for laminated glass</li> </ul>	
	Lamp	Head lamp, Room lamp, Halogen lamp, Lamp for measuring instrument	x	x				<ul style="list-style-type: none"> <li>- Because they are minor parts, it is difficult to separate or to include in material list</li> </ul>	<ul style="list-style-type: none"> <li>- Prohibit the use of hazardous substances or develop a method for removing them</li> </ul>	
	Others	Mirror, Measuring instrument	x	x				<ul style="list-style-type: none"> <li>- Difficult to list in the material list because they are minor parts</li> </ul>	<ul style="list-style-type: none"> <li>- Structure to facilitate separation and listing of resin materials</li> </ul>	

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									- Rubber is difficult to separate (Because it is bonded)	
Air conditioner	Air conditioner (Condenser, Radiator)		x						- The use of composite materials for condenser and radiator makes it impossible to separate them. - Single element metal is reused as scrap (Refer to the description for radiator)	- Structure and technology to facilitate separation into single element metal  - Develop parts made of single element metal like all aluminum, copper and stainless steel
	Compressor		x						- Loaded into an electric furnace as is or separated for reuse as copper and iron	- Structure to facilitate separation and listing of resin materials
	Refrigerant (CFC)								- After being drawn out, reused or destructed	- Recovery and treatment is made compulsory since April 2002 (@Law for Recovery of CFC)
Rubber parts	Seal O-ring, Rubber sheet Dust seal, Oil seal Seal tape			x					- Difficult to list in the material list because they are minor parts - Difficult to separate because of incorporated construction - Difficult to separate because of composite materials	- For parts similar to those for cars (interior parts of cabin, parts around driver's seat, electrical components, air conditioners, resin exterior parts), make use of the technology and materials for recycling to be developed by the car industry so as to allow the future use of the car recycling route.
	Damper Rubber cushion (Metal ring with/without blade)		x	x						
	Boot For cylinder For cable			x						
	Belt Engine, Compressor			x						
	Insulator Interference prevention parts For piping, for hose For battery terminal Grommet			x						
	Fastening parts Piping sleeve Corrugated sleeve Fastener			x						
	Water proofing parts Weather strip (Air-tight, Water-tight)			x						
	Others Rubber coating, Handle, Wiper blade, Pedal cover		x	x						
Others	Sound absorbing material		x	x					- Not recyclable because they are bonded with adhesives, damaged and soiled	
	Operator seat (Cushion, Back seat)		x	x					- Not separable into each material such as surface cover and iron	