

Embodied Carbon Disclosure: Air-Cooled Oil-Free Centrifugal Chiller

TM65 North American Methodology, ASHRAE® and CIBSE 2024

Last Updated: October 2024; contact your account manager with questions. Please do not distribute without permission.



Results			
Life Cycle Stage	Results per unit (kg CO2-eq)	Results per-kg product weight (kg CO2-eq)	Notes
A1. Material Extraction	24,578	2.75	Material emission factors sourced from TM65:2021 table 2.1 and TM65NA:2024 table 2.1. Greater than 95% of material composition accounted for. Assumed steel for any weight unaccounted for in raw material composition.
A2. Transport to Factory	3,338	0.37	Calculated based on average transport distance from supplier to factory location. Transport emission factors from TM65NA: 2024 table 2.4.
A3. Manufacturing	2,812	0.31	Electricity Carbon Factor for RFCM eGRID region from TM65NA:2024 table 2.6. Gas carbon factors from TM65NA:2024 table 2.10. As per TM65NA:2024 table 2.5, assumed 4 rounds of manufacturing.
A4. Transport to Site	2,072	0.23	Used TM65NA:2024 assumption of 1,600 km transport to site, per table 2.11. Transport emission factors from TM65NA: 2024 table 2.4.
B1. Use (Refrigerant Leakage During Product Life)	292,674	32.77	Refrigerant GWP from TM65NA:2023 table 2.3. Used AR6 value. Annual leak rate calculations use industry-assumed values per TM65NA:2024 table 2.2. Actual values will differ based factors such as maintenance and unit configuration.
B3. Repair	3,369	0.38	TM65:2021 assumption, Table 4.6, value is 10% of A1-A4 + 10% of C2-C4
C1. Deconstruction (Refrigerant Leak at End of Product Life)	48,779	5.46	Refrigerant GWP from TM65NA:2023 table 2.3. Used AR6 value. End of life leak rate calculations use industry-assumed values per TM65NA:2024 table 2.2, actual values will vary based on recovery practices.
C2. End of Life Transport	130	0.01	Per TM65NA:2024 Table 2.5, assumed transport of 100 km by truck. Transport emission factors from TM65NA: 2024 table 2.4.
C3. Waste Processing	703	0.08	Per TM65:2021 Table 4.7, assumed processing energy use equal to one round of manufacturing energy use from A3. Manufacturing.
C4. Disposal	59	0.01	Assumed 85% of metals in product recycled, other materials sent to landfill. Sourced landfill emission factor from TM65NA:2024 table 2.13.
Embodied carbon without refrigerant leakage			
A1-C4 (excluding B1, C1)	37,060	4.15	
A1-C4 with buffer factor (excluding B1, C1)	48,178	5.39	1.3 buffer factor per TM65:2021
Refrigerant leakage only			
B1 + C1	341,453		
Total Embodied Carbon			
All life cycle stages, without buffer factor	378,513		
All life cycle stages, with buffer factor	389,631		

Product Details

Model: Air-Cooled Oil-Free Centrifugal Chiller TCAA

Unit Selected for Analysis: 220 ton

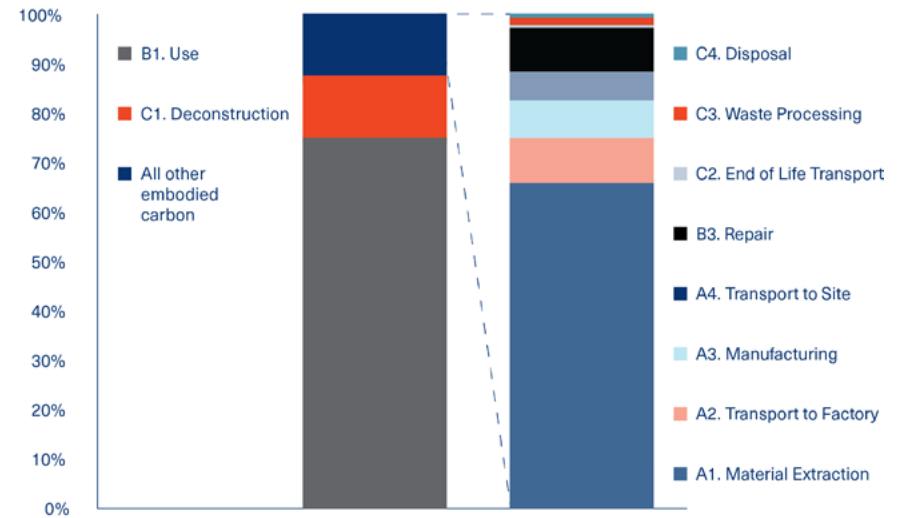
Unit Weight (shipping weight unless otherwise specified): 8,932 kg

Size Range: 60-440 tons

Refrigerant & Charge: R-513A, 362.4 kg; GWP = 673 (AR6)

Manufacturing Location: Grand Rapids, MI

Modeled Product Lifetime: 20 years



Other Data, Details, Notes

TM65 Complexity Category: Category 3: High Complexity

Estimated refrigerant leakage; values prescribed by TM65 North American Methodology (2024), Table 2.2:

- Annual leak rate: 6%
- End of life recovery rate: 80%

Repair and replacement rate per TM65: 10%

This calculation was performed for a selected unit configuration and size. It is reasonable to assume that the per-kg product weight results can be extrapolated to all sizes in the model range, using each unit's respective shipping weight, given similarities in raw materials, manufacturing, supply chain, and end of life. However, *it is recommended to perform bespoke refrigerant leakage calculations for each different size using the refrigerant charge amounts listed in the product manual.*



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