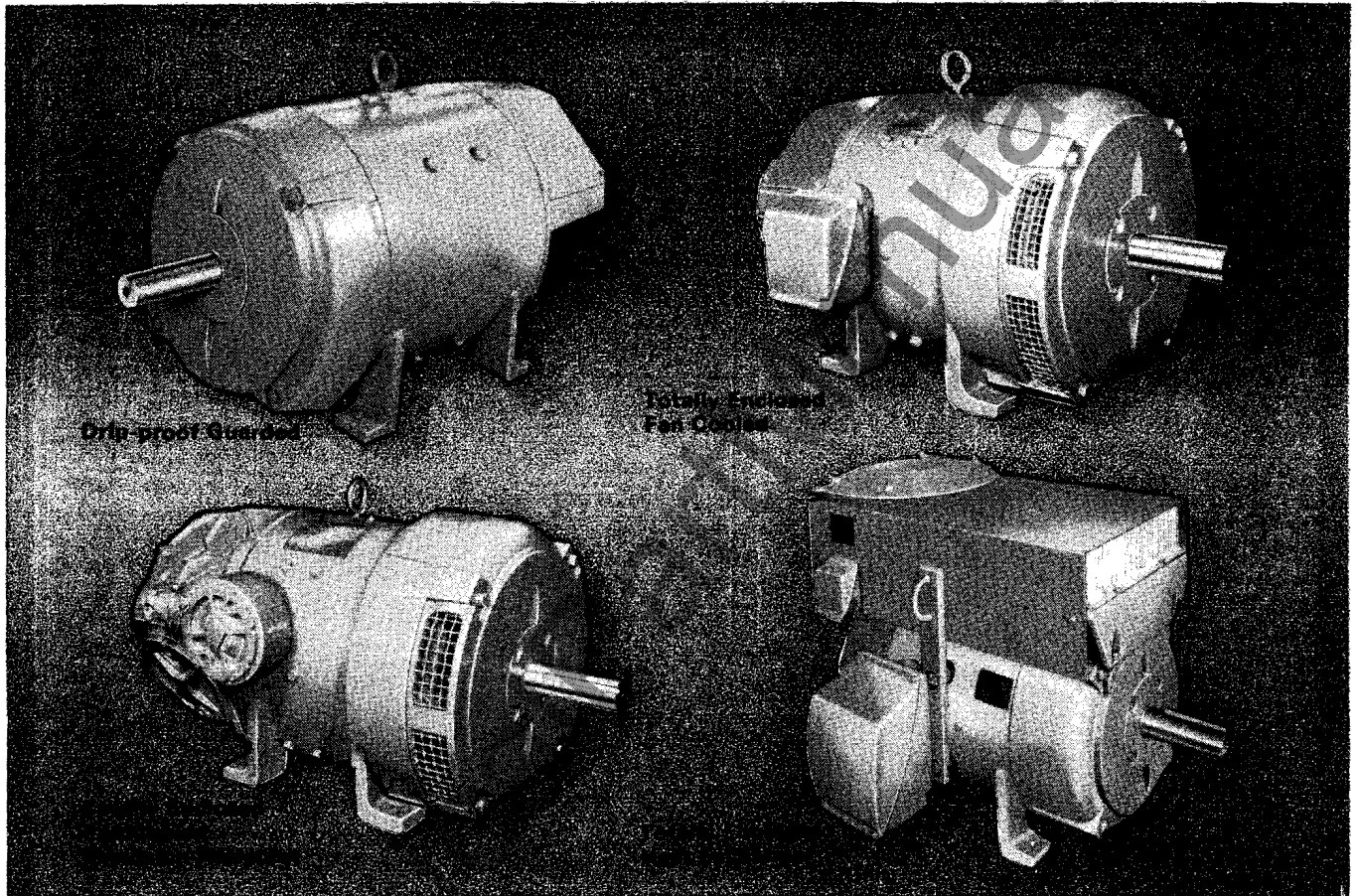


Westinghouse



Dc Motors, Generators, Exciters, Life-Line H

Type SK-H
Drip-proof Guarded, Totally Enclosed
Explosion Proof, Heat Exchanger



Application

Life-Line H dc motors and generators are designed to meet the demands of modern, highly automated industrial drives for wide speed range, fast reversing or speed changes, automatic control of speed or torque, or accurate regulation of these variables. These versatile motors are suitable for a wide variety of applications requiring either constant or adjustable speed. Similarly, Life-Line H generators and exciters are applicable wherever a source of dc power is required—for dc power systems, for control circuits or for excitation of ac synchronous motors and generators.

Life-Line H dc motors and generators are available in varied enclosures to meet every application need.

Drip-proof guarded dc motors provide the required protection for normal industrial applications.

Totally enclosed dc motors are suitable for service in locations where abrasive or metallic dust is present such as in mines,

factories, foundries, cement and rock product plants, coal tipples, machine shops and steel mills. They may also be applied in chemical plants, canneries, packing houses and similar industrial plants where splashing liquids and chemicals are encountered.

Explosion resistant dc motors are designed to meet Underwriters' Laboratories, Inc., Class I, Group D requirements (no label) or Bureau of Mines requirements (with label) for use with permissible mining machines.

Heat exchanger dc motors offer capacities beyond those of totally enclosed, fan cooled motors by providing a direct transfer of heat from its sources to ambient air by circulating inner air through a heat exchanger and outer air over the heat exchanger. They are designed for reliable performance under severe atmospheric conditions.

User Benefits

Insulation System: The high temperature capability of the insulation system exceeds

the full load operating temperature of the class F designs. Resistance to moisture, chemicals and oils is provided by inherent qualities. Application flexibility is increased. A continuous insulation research, development, and proven field performance program is provided and keeps modernizing this new balanced, compatible insulation system.

Controlled Ventilation: Moves more air, positively distributes it for best cooling advantage, cleans machine parts instead of contaminating them. Result—armature inertia can be reduced for fastest response, machines last longer, maintenance and down time are reduced.

Fastest Response: A reduction in armature inertia of up to 55%, with a lower electrical inertia—up to 30% lower field time constant, plus a 35% increase in commutating ability permit rapid response—faster accelerations—reversals—speed changes. These rapid response features of Life-Line H mean more production, better product quality, fewer processing complications.

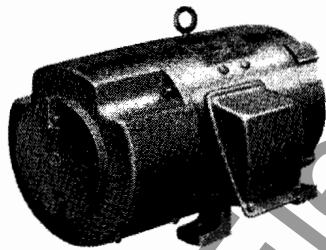
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Design and Construction Features

- ① Insulation – see page 3
- ② Controlled Ventilation:
 - Drip-proof guarded – see page 4
 - Totally enclosed, fan cooled – see page 4
 - Totally enclosed, heat exchanger – see page 5
- ③ Fastest response – see page 5
- ④ Maximum protection – see page 6
- ⑤ Brush assembly – see page 6
- ⑥ Armature – see page 7
- ⑦ Bearings – see page 7
- ⑧ Conduit Box – see page 7

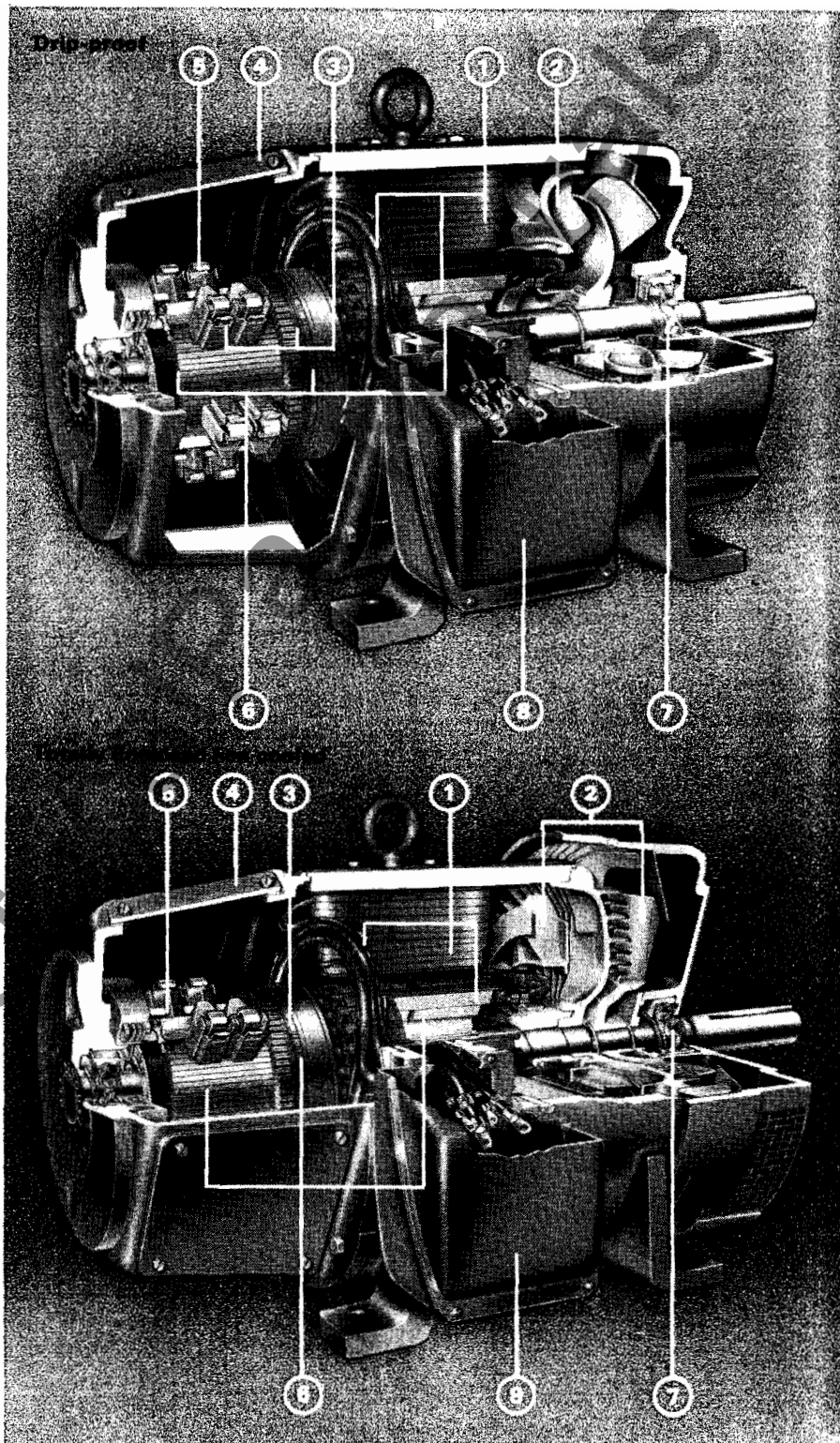
Totally Enclosed, Non-Ventilated Frames 187A-218A



Ratings built on frames 187A to 218A, inclusive, are totally enclosed, non-ventilated. The picture shown above is typical of these frames.

The three-sided armature bracket provides the same ease of armature and brush inspection as the five-sided bracket used on frames 256A and larger.

Cooling is accomplished by radiation and natural convection.



Dc Motors, Generators, Exciters, Life-Line H

Type SK-H

Drip-proof Guarded, Totally Enclosed
Explosion Proof, Heat Exchanger

Insulation

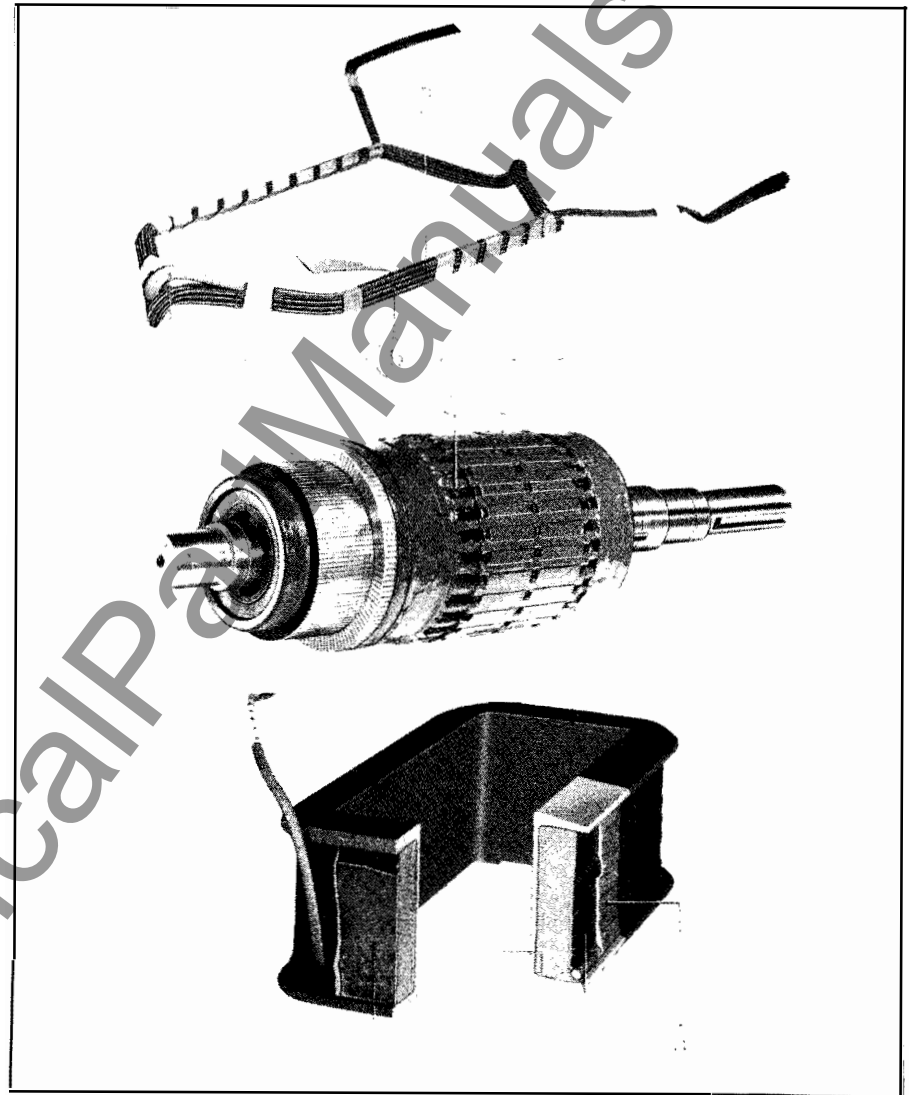
Insulation is a key factor in electrical machine capacity, life and trouble-free performance. Westinghouse provides extra insulation capacity in all dc motors, generators and exciters. Life-Line H combines a high temperature insulation system with the full complement of iron and copper required by low temperature rise standards. This new, balanced, compatible insulation system is used on all Life-Line H, type SK-H motors and generators designed and guaranteed for class F temperature.

Our extensive research and development programs backed by proven field performance proved the high temperature system has greater short term reliability — more than ample thermal stability margin — than ordinary class F. These facts high-light three important benefits. First, insulation — long an important maintenance item — is eliminated as a limiting factor on motor life under normal operation. Second, even with heavy emergency overloads or abnormal ambients Life-Line H motors will go right on working in many cases where ordinary motors would burn out immediately or show extremely shortened life. Finally, Life-Line H motors can safely handle many tough duty cycles where current peaks make an ordinary class F motor of the same size unsatisfactory even though averages (rms) are within rating. As a result, life is greatly extended, maintenance and down time are drastically reduced — particularly in emergencies when they cause the most trouble. Application flexibility is increased. Life-Line H saves money, increases production, meets emergencies with a high temperature insulation system.

Armature conductors are coated with high temperature enamel carefully selected and tested to be compatible with the rest of the insulation system. Conductor insulation is reinforced at critical points with close weave glass or glass-dacron tape pretreated with high temperature resin or with high temperature film.

Extra protection is provided at cross-overs and similar points inside the coil by treated glass and asbestos strips, glass sleeving and similar reinforcing and barrier materials.

All-around ground insulation is provided by a well consolidated, high dielectric strength ground wall combining high temperature bonding resins with tough, flexible barrier and reinforcing materials. On small machines a combination is formed into high



tear strength slot cells. On large machines wrappers are generally used.

Entire armature is high temperature varnish treated with multiple dips and bakes to give thorough impregnation and coating to provide a well filled and sealed unit with high bond strength, thermal stability and protection against dirt, moisture, solvents and other chemicals. This special high temperature varnish gives a smooth, dirt repellent surface.

Field coils vary in design (shunt wound, shell type shown), to give the best combination of insulation reliability, heat dissipation and use of space, according to the particular application.

High temperature enamel or strip insulated conductors depending on size.

High dielectric strength insulation provides a barrier between coil and leads.

Complete coil is vacuum impregnated with varnish and baked for external protection. This forms a solid mass of copper and insulation, impervious to liquids, vapor, dirt.

Westinghouse



Design and Construction Features Continued

2 Controlled Ventilation

In both drip-proof guarded and totally enclosed fan cooled ventilation systems, the

rate of heat dissipation is dependent on motor shaft speed. In the totally enclosed, heat exchanger system, the speed of heat transfer is independent of motor shaft speed. The unique ventilation systems in Life-Line H move more air through the armature and positively distribute air for most advanta-

geous cooling. Real use is made of the armature core ducts and coil ends for cooling where it can do the most good. Therefore, armature size can be reduced for lowest inertia, usual "hot spots" run cooler, Life-Line H performs better, lasts longer, reduces maintenance and down time.

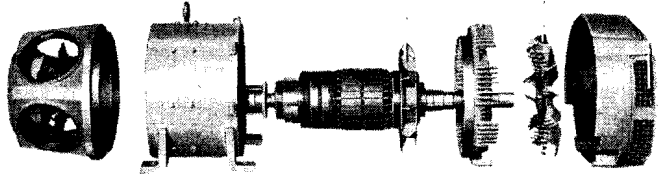
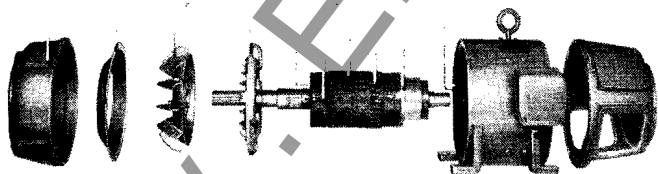
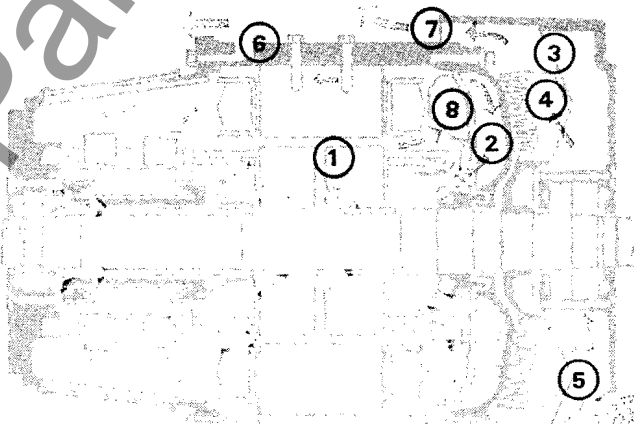
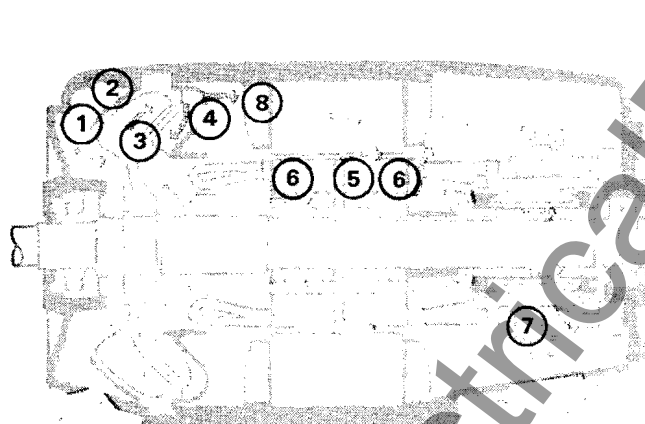
Here's how controlled ventilation works:

Drip-proof Guarded, Life-Line H

A large aluminum fan ③ in conjunction with an air shield ② and a specially designed diffuser ④ forces air into the machine from the drive end bracket ①. Flow is toward the commutator end, the diffuser positively divides the air to best advantage—most to the armature ⑤ some directly to the fields ⑥. With flow toward the commutator end and with positive air distribution, the natural fans ⑦ in the armature add to, instead of buck or prevent, the flow. Finally, conducting carbon dust created at the commutator ⑧ by normal brush wear is carried directly out of the machine.

Totally Enclosed, Fan Cooled, Life-Line H

Cooling air is drawn in through the sides and bottom of the external bracket ⑤ not through the face of the bracket. The air shield ③ directs the air through the blower and the ribs of the heat exchanger ②. Air moves through the armature ① and is distributed by the aluminum fan ④ for the most advantageous transfer of heat from the armature ① to the heat exchanger ② and frame ⑥. The external fan ④ constantly moves air over the heat exchanger and frame to carry off the heat and cool the motor. The aluminum heat exchanger ② carries off heat more effectively due to the counter flow movement of the air. Directional vanes force the air through the large discharge opening ⑦ to exhaust along the entire length of the frame.



Dc Motors, Generators, Exciters, Life-Line H

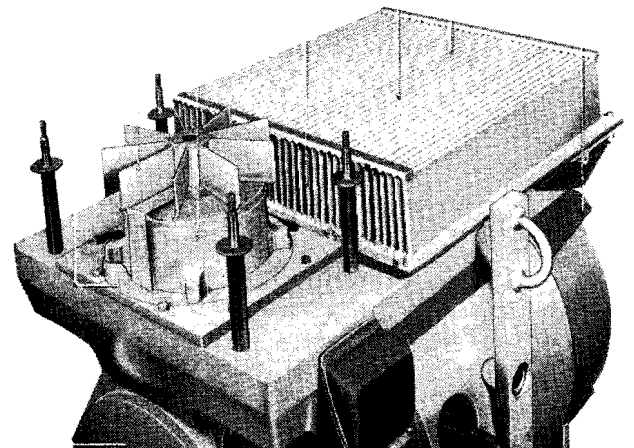
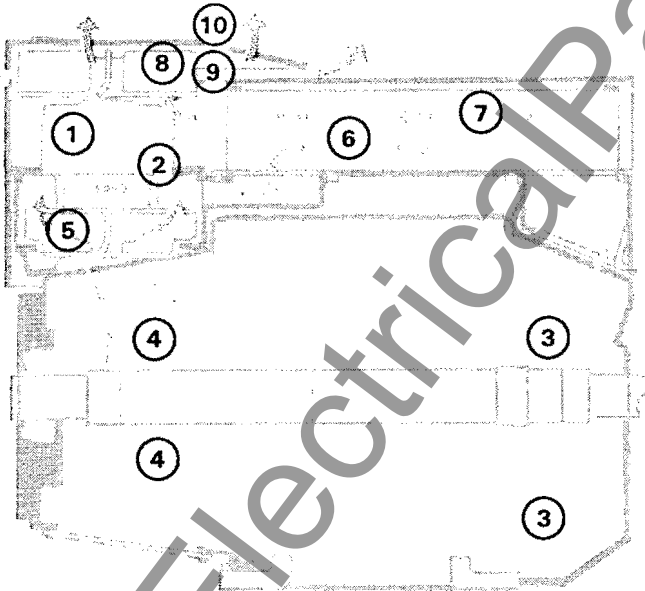
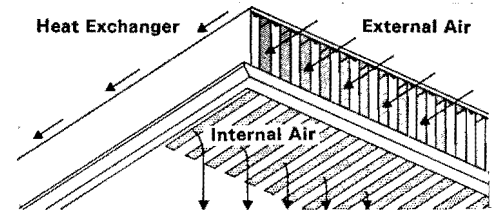
Type SK-H
Drip-proof Guarded, Totally Enclosed
Explosion Proof, Heat Exchanger

Totally Enclosed, Heat Exchanger, Life-Line H

A vertically mounted motor ① drives blowers for both internal and external air circulation and its flange ② serves as a seal between the two air circuits. Internal air is circulated through the motor from the drive end ③ to the commutator end ④, passing through the internal blower ⑤ and into the heat exchanger ⑥, and then discharged into the drive end of the motor ③. Cool outside air is drawn from the drive end, through the aluminum air ducts ⑦ of the heat exchanger, into the external blower ⑧, and exhausted up and out of a discharge opening ⑨ above the blower motor at the commutator end. A cover ⑩ is provided over the opening to prevent objects from falling into the blower. The internal and external air move in opposite directions in the exchanger providing maximum heat dissipation from all surfaces.

- **Compact Unit** Top mounted, rectangular shaped heat exchanger does not extend over outside dimensions of motor. Although a totally enclosed motor, the unit obtains full drip-proof rating without increasing the frame size of the motor.
- **Full Cooling** Separate, totally enclosed ac motor drives blowers for both external and internal air circulation of the dc motor, and in turn is cooled by this same air circulation.

- **No Filters Required** Straight through air passage of external air provides self-cleaning action. Heat exchanger aluminum air ducts are open on top and sides for easy access for cleaning when required, due to severe dust and moisture conditions.
- **Thermostatic Protection** Main motor protected against burnouts in the event of extreme overload, or failure of ac power supply to blower motor.
- **Easy to Install** Factory assembled and shipped as a complete unit. Heat exchanger construction permits top, sidewall or ceiling mounting.
- **Life-Line H Features** These totally enclosed units include all the efficiency and adaptability of Life-Line H dc motors.



Fastest Response

Life-Line H ultra fast response provides the flexibility required for modern automation control. Rapid response is produced by low mechanical and electrical inertia and high commutating ability.

Low Inertia Because of controlled ventilation which gives really effective armature cooling, balanced distribution between armature and fields of ordinary amounts of

material results in an extraordinary reduction in armature inertia – up to 55%. Similarly, Life-Line H has up to 30% lower field time constant – the electrical inertia important to generator response.

High Commutating Ability Life-Line H has increased commutating ability – 35% more than previous motors. A large number of commutator segments minimizes bar-to-bar voltage and low turns per coil reduce commutating voltage. Full use of iron in the

commutating magnetic circuit reduces saturation, increases the loads that can be commutated. The full complement of commutating poles are laminated to minimize time lag of neutralizing flux.

Westinghouse



Design and Construction Features Continued

Maximum Protection

Frame is made of heavy rolled steel for strength and best magnetic properties. Heavy, low carbon steel feet, welded to frame, will not break. A weight-centered eyebolt provides easy, balanced, safe lifting.

Brackets are cast for maximum rigidity to hold bearing alignment. Deep machined rabbets at the bracket and frame provide perfect alignment, assure long bearing life, seal fits against dirt and water. Knock off lugs and bolt guides make bracket removal and reassembly easy.

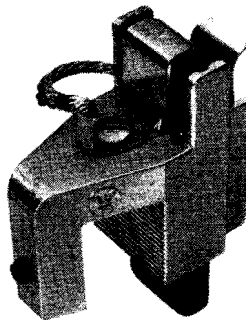
Commutator End Bracket has extra large access openings, directly over the brushholders, for easy brush maintenance and inspection. Covers, for drip-proof guarded and fan cooled motors, are gasketed for positive sealing. Explosion proof commutator bracket features four hand holes with screw-type covers.

Drip-proof guarded motors have an air shield in the drive end bracket which provides additional splash protection of windings. Both drip-proof and fan-cooled motors cooling fan is protected by the cast external drive end bracket and air shield.

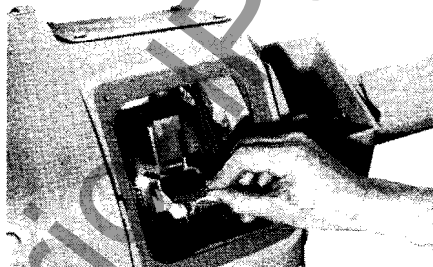
Totally enclosed, fan-cooled motors external bracket openings are in the sides and bottom—not the face of the bracket. The aluminum external fan and heat exchanger in fan-cooled motors are protected from corrosion by a vinyl finish system.

Heat exchanger motors have all the features of totally enclosed motors, plus an independent cooling system . . . provide reliable performance under severe atmospheric conditions where open or partially enclosed motors are difficult to maintain. The blower motor and main motor have separate conduit boxes thus isolating the ac and dc circuits.

Brush Assembly



No adjustment is required for the compress brushholders. Individually positioned brushes of solid or split design provide improved commutation. Uniform tension on the brush is maintained throughout its travel by a stainless steel roll spring acting on the center of the brush. A serrated mounting surface where the brushholder is mounted on a rod, and a self-locking setscrew, provide positive securing of the brushholder without danger of its shifting.



Quick and easy brush inspection and maintenance. Brushholders and brushes are situated in easy view, and are readily accessible through extra-large access holes. The top of the stainless steel retainer, located over the brushes, acts as a convenient fingerhold to squeeze and lift the retainer out to check or change brushes. A pin is included which allows the retainer to be swung out of the way, but does not impair

its functioning. It also prevents the dropping of the retainer when brushes are checked or changed.

Armature

The Life-Line H armature is an integrated combination of many features that provide long life, negligible maintenance, high commutating ability and performance characteristics under tough service conditions.

Core is built up of annealed and insulated laminations for best magnetic response and minimum loss. Laminations on 256 frame and larger are fastened at the shaft with toggle clamps or with rivets through the core. These clamps or rivets are out of the flux area and, therefore, do not interfere with its flow. Hence, iron is used fully and commutating magnetic circuit saturation reduced, increasing the load limit for successful commutation. Axial and radial ducts in the core, plus controlled ventilation provide maximum cooling. Frames 180 through 210 have punchings assembled on a knurled shaft with no vent ducts.

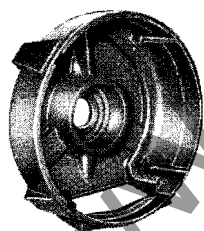
Core and coil assembly is impervious to effects of centrifugal forces, dirt, moisture and expansion and contraction resulting from temperature cycles. Coils are held firmly in place with laminated wedges in the core and steel bands insulated by layers of glass and asbestos or glass bands on the coil extensions. The entire core-coil assembly is high temperature varnish treated.

Silver bearing copper commutator segments stay hard at high temperature. Together with top quality mica and a balanced combination of arch and vee binding, they make a permanently solid commutator, assure a smooth brush ride for best commutation.

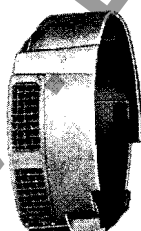
High tensile axle steel shaft is keyed to core and commutator and can be pressed out and in without disturbing the windings.

Complete armature assembly is dynamically balanced for smooth, trouble-free operation.

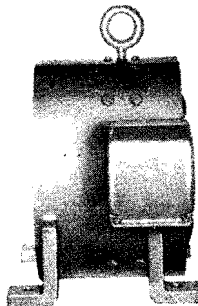
Drive End



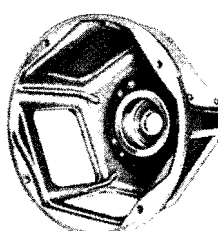
Drip-proof

Totally Enclosed
Fan Cooled

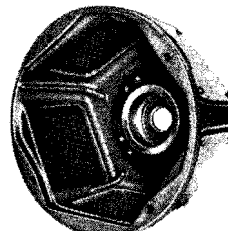
Frame



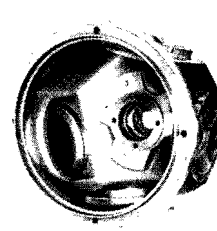
Commutator End



Drip-proof



Totally Enclosed



Explosion-proof

Dc Motors, Generators, Exciters, Life-Line H

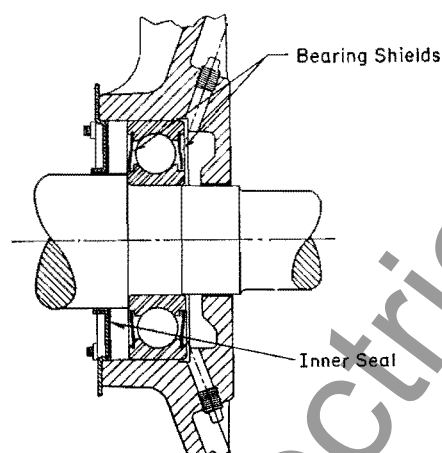
Type SK-H
Drip-proof Guarded, Totally Enclosed
Explosion Proof, Heat Exchanger

Bearings

Extra large ball bearings, suitable for belted loads are standard on all frame sizes except the 840 frame series. High thrust capacity permits vertical mounting as long as the thrust load does not exceed the armature weight.

Frame sizes 187 through 507

Bearings have twin bearing shields to exclude dirt, prevent excessive grease churning, and meter grease entrance to protect against over lubrication. Inner bearing caps on the 365A and larger frames and rotating seals on the 326A and smaller frames keep grease from entering the machine. These bearings are packed at the factory with special Westinghouse lubricant — there is no need for greasing over many years of operation under most conditions. However, greasing and drain ports are provided on these machines for use if service lubrication is desirable.



Frame sizes 584 through 848 AS

Bearings are open ball type, except for the 580A and 680A frame series for belted applications in which case the rear bearing is a cylindrical roller type, all having an inner bearing cap to exclude dirt and protect against grease from entering the machine. These bearings require periodic greasing depending on application. For specific instructions on greasing see the Instruction Manual for the particular apparatus.

Conduit Box



Easy connection is assured. Leads are marked in relief on metal tags for clear identification. A wiring diagram inside the cover makes connection quick and simple.

Maximum flexibility is provided. Conduit box may be rotated in 90-degree steps for bottom, horizontal or top entrance. The standard conduit box is adequate to contain and make all necessary connections. Oversize conduit boxes are available upon



request. For conduit box dimensions refer to dimension leaflet.

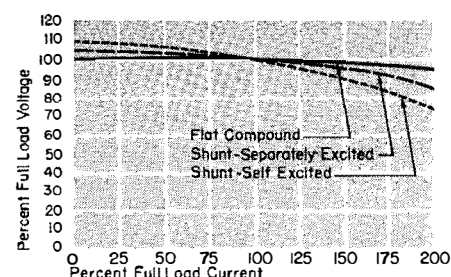
Explosion resistant machine is furnished with an explosion-proof cast iron conduit box as standard. Cable changes can be made without removing brackets. Machines to meet Bureau of Mines Standards are furnished with cable and hose and packing gland maintaining maximum flexibility.

Best Performance Characteristics

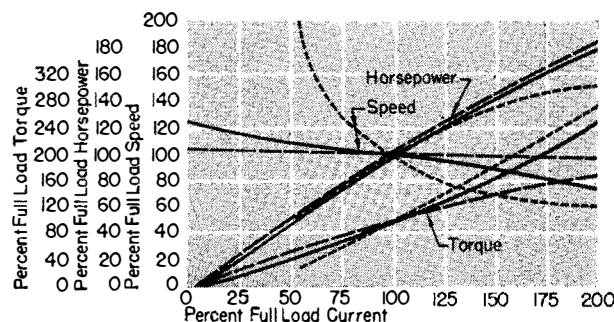
Life-Line H motors are available with shunt, compound or series windings to meet all types of operating characteristic requirements. On shunt machines, large air gaps, oversize field coils and special pole faces give near linear regulation that means sure performance in automatic systems without costly control complications. Also, on shunt motors up to 60 hp stable operation is obtained without a series winding. Hence, control apparatus is reduced. Life-Line H generators are available, both shunt and compound wound.

Shunt — — — — —
Compound — — — — —
Series — — — — —

Life-Line H Generator Characteristics



Life-Line H Motor Characteristics



Dc Motors, Generators, Exciters, Life-Line H

Type SK-H

Drip-proof Guarded, Totally Enclosed

Explosion Proof, Heat Exchanger

Standard Specifications

Drip-proof, Totally Enclosed Heat Exchanger

	Motors	Generators
Ratings	½ to 1250 hp	¾ to 900 kw
Speeds	300 to 3500 base rpm	850 to 3450 rpm
Voltages	½ to 10 hp – 120 and 240 volts; 15 to 200 hp – 240 and 500 volts; 250 to 1000 hp – 500 volts	125 and 250 volts
Windings	Shunt, compound, series	Shunt, compound
Frames	186A to 848AS	186A to 848AS
Starting or Inrush Current	up to 500% starting	200% inrush
One Minute Current	150% throughout speed range	200% throughout voltage range
Speed or Voltage Range – Field Control	Speed range: up to 4:1 depending on rating and power supply	Voltage range: self-excited – 80 to 110%; separately excited – residual to 110%
Speed Range – Armature Control	Unlimited – low speed rating depends on duty cycle – refer application to the Company	
Mounting	Foot mounted – any position	Foot mounted – any position

Further Information

Prices: See Price Lists 3520 (Motor), 4520 (Generator)

Dimensions: See Dimension Sheets 3540

Modifications: See Price Lists 3521 (Motor), 4521 (Generator)

Application: Refer to Westinghouse (Motor Specifications), See Application Data 4560 (Generator).

Totally Enclosed: Non-Ventilated Fan Cooled and Explosion-Proof

	Motors	Generators
Ratings	½ to 75 hp	¾ to 40 kw
Speeds	300 to 3500 base rpm	850 to 3450 rpm
Voltages	½ to 10 hp – 120 and 240 volts; 15 to 60 hp – 240 and 500 volts	125 and 250 volts
Windings	Shunt, compound, series	Shunt, compound
Frames	187A to 448A	187A to 448A
Starting or Inrush Current	up to 500% starting	300% inrush
One Minute Current	150% throughout speed range	200% throughout voltage range
Speed or Voltage Range – Field Control	Speed range: up to 4:1 depending on rating and power supply	Voltage rating: self-excited – 80 to 110%; separately excited – residual to 110%
Speed Range – Armature Control	Unlimited – low speed rating depends on duty cycle – refer application to the Company	
Mounting	Foot mounted – any position	Foot mounted – any position