CPC COOPERATIVE PATENT CLASSIFICATION

F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING
(NOTE omitted)

ENGINES OR PUMPS

F04 POSITIVE - DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS FOR LIQUIDS OR ELASTIC FLUIDS
(NOTE omitted)

F04C ROTARY-PISTON, OR OSCILLATING-PISTON, POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS (engines F03C); ROTARY-PISTON, OR OSCILLATING-PISTON, POSITIVE-DISPLACEMENT PUMPS

NOTE
Attention is drawn to the notes preceding class F01 especially as regards the definitions of "machines", "pumps", "positive displacement", "rotary-piston machines", "oscillating-piston machines", "rotary piston", "co-operating members", "movement of co-operating members", "teeth or tooth-equivalents" and "internal axis".

WARNING
In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

2/00 Rotary-piston machines or pumps (with non-parallel axes of co-operating members F04C 3/00; with the working-chamber walls at least partly resiliently deformable F04C 5/00; with fluid ring or the like F04C 7/00; rotary-piston pumps specially adapted for elastic fluids F04C 18/00; rotary-piston machines or pumps in which the working-fluid is exclusively displaced by, or exclusively displaces, one or more reciprocating pistons F04B)

NOTE
Group F04C 2/30 takes precedence over groups F04C 2/02 - F04C 2/28

2/02 . . of arcuate-engagement type, i.e. with circular translatory movement of co-operating members, each member having the same number of teeth or tooth-equivalents

2/025 . . [the moving and the stationary member having co-operating elements in spiral form]

2/04 . . of internal axis type

2/045 . . [having a C-shaped piston]

2/06 . . of other than internal-axis type (F04C 2/063 takes precedence)

2/063 . . with coaxially-mounted members having continuously-changing circumferential spacing between them

2/067 . . having cam-and-follower type drive

2/07 . . having crankshaft-and-connecting-rod type drive

2/073 . . having pawl-and-ratchet type drive

2/077 . . having toothed-gearing type drive

2/08 . . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing

2/082 . . [Details specially related to intermeshing engagement type machines or pumps]

2/084 . . [Toothed wheels]

2/086 . . [Carter]

2/088 . . [Elements in the toothed wheels or the carter for relieving the pressure of fluid imprisoned in the zones of engagement]

2/10 . . of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member

2/101 . . [with a crescent-shaped filler element, located between the inner and outer intermeshing members]

2/102 . . [the two members rotating simultaneously around their respective axes]

2/103 . . [one member having simultaneously a rotational movement about its own axis and an orbital movement]

2/104 . . [having an articulated driving shaft]

2/105 . . [Details concerning timing or distribution valves]

2/106 . . . . [Spool type distribution valves]

2/107 . . . . with helical teeth

2/1071 . . . . [the inner and outer member having a different number of threads and one of the two being made of elastic materials, e.g. Moineau type]

2/1073 . . . . [where one member is stationary while the other member rotates and orbits]

2/1075 . . . . . . [Construction of the stationary member]

2/1076 . . . . . . [where one member orbits or wobbles relative to the other member which rotates around a fixed axis]

2/1078 . . . . . . [where one member rotates and both members are allowed to orbit or wobble]
with the outer member

- of other than internal-axis type

- [with radially or approximately radially from the rotor body extending tooth-like elements, co-operating with recesses in the other rotor, e.g. one tooth]

- [with radially from the rotor body extending elements, not necessarily co-operating with corresponding recesses in the other rotor, e.g. lobes, Roots type]

- with toothed rotary pistons

- with helical teeth, e.g. chevron-shaped, screw type {{for non-parallel axes of movement F04C 3/00}}

- {having more than two rotary pistons with parallel axes}

- with similar tooth forms {{F04C 2/16 takes precedence}}

- with dissimilar tooth forms {{F04C 2/16 takes precedence}}

- of internal-axis type with equidirectional movement of co-operating members at the points of engagement, or with one of the co-operating members being stationary, the inner member having more teeth or tooth-equivalents than the outer member

- of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions

- of internal-axis type

- of other than internal-axis type

- having the characteristics covered by two or more groups F04C 2/02, F04C 2/08, F04C 2/22, F04C 2/24 or having the characteristics covered by one of these groups together with some other type of movement between co-operating members

- having both the movement defined in groups F04C 2/02 and relative reciprocation between co-operating members

- {with vanes hinged to the inner member and reciprocating with respect to the inner member}

- {with vanes hinged to the outer member and reciprocating with respect to the outer member}

- with vanes hinged to the inner member and reciprocating with respect to the outer member

- and hinged to the outer member

- {with vanes hinged to the outer member and reciprocating with respect to the inner member}

- and hinged to the inner member

- having the movement defined in groups F04C 2/08 or F04C 2/22 and relative reciprocation between the co-operating members

- with vanes reciprocating with respect to the inner member

- {the inner and outer member being in contact along one line or continuous surface substantially parallel to the axis of rotation}

- {the surfaces of the inner and outer member, forming the working space, being surfaces of revolution}

- {with a separation element located between the inlet and outlet opening}

- {the vanes having the form of rollers, slippers or the like}

- {the inner and outer member being in contact along more than one line or surface}

- {the vanes having the form of rollers, slippers or the like}

- {with axially movable vanes}

- the vanes positively engaging, with circumferential play, an outer rotatable member

- the vanes being pivoted on the axis of the outer member

- with vanes reciprocating with respect to the outer member

- {the inner and outer member being in contact along one line or continuous surface substantially parallel to the axis of rotation}

- {the surfaces of the inner and outer member, forming the working space, being surfaces of revolution}

- {the inner and outer member being in contact along more than one line or surface}

- {with axially movable vanes}

- having both the movements defined in groups F04C 2/22 and F04C 2/24

- {with a separation element located on the axis of revolution}

- {the vanes having the form of rollers, slippers or the like}

- {with a separation element located on the axis of revolution}

- of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions

- {with axially movable vanes}

- having both the movements defined in groups F04C 2/22 and F04C 2/24

- {with a separation element located on the axis of revolution}

- {the vanes having the form of rollers, slippers or the like}

- {with a separation element located on the axis of revolution}

- {the vanes hinged to the inner as well as to the outer member}

- having the movement defined in group F04C 2/08 or F04C 2/22 and having a hinged member

- with vanes hinged to the inner member

- with vanes hinged to the outer member

- Rotary-piston machines or pumps, with non-parallel axes of movement of co-operating members, e.g. of screw type (with the working-chamber walls at least partly resiliently deformable F04C 5/00; rotary-piston pumps with non-parallel axes of movement of co-operating members specially adapted for elastic fluids F04C 18/48)

- the axes being arranged at an angle of 90 degrees

- of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing

- the axes being arranged otherwise than at an angle of 90 degrees

- of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing

- {the axes of cooperating members being on the same plane}

- Rotary-piston machines or pumps with the working-chamber walls at least partly resiliently deformable (such pumps specially adapted for elastic fluids F04C 18/00)

- Rotary-piston machines or pumps with fluid ring or the like (such pumps specially adapted for elastic fluids F04C 19/00)

- Oscillating-piston machines or pumps (such pumps specially adapted for elastic fluids F04C 21/00)

- {the piston oscillating around a fixed axis}
11/00 Combинаtions of two or more machines or pumps, each being of rotary-piston or oscillating-piston type (combinations of such pumps specially adapted for elastic fluids F04C 23/00); Pumping installations (F04C 13/00 takes precedence; specially adapted for elastic fluids F04C 23/00; fluid gearing F16H)

**NOTE**

Multi-stage engines, motors, pumps or compressors with stages connected in series or in parallel are not considered as having complementary function

11/001 . . . (of similar working principle)
11/003 . . . (having complementary function)
11/005 . . . (of dissimilar working principle)
11/006 . . . (having complementary function)
11/008 . . . (Enclosed motor pump units)

13/00 Adaptations of machines or pumps for special use, e.g. for extremely high pressures (of pumps specially adapted for elastic fluids F04C 25/00)

13/001 . . . (Pumps for particular liquids)
13/002 . . . . . (for homogeneous viscous liquids)
13/004 . . . . . (with means for fluidising or diluting the material being pumped)
13/005 . . . (Removing contaminants, deposits or scale from the pump; Cleaning)
13/007 . . . (Venting; Gas and vapour separation during pumping (preventing vapour lock in fuel pumps F02M 37/20, in centrifugal pumps F04D 9/00))
13/008 . . . (Pumps for submersible use, i.e. down-hole pumping)

14/00 Control of, monitoring of, or safety arrangements for, machines, pumps or pumping installations (of pumps or pumping installations specially adapted for elastic fluids F04C 28/00)

14/02 . . . specially adapted for several machines or pumps connected in series or in parallel
14/04 . . . specially adapted for reversible machines or pumps
14/06 . . . specially adapted for stopping, starting, idling or no-load operation
14/065 . . . (Capacity control using a multiplicity of units or pumping capacities, e.g. multiple chambers, individually switchable or controllable)
14/08 . . . characterised by varying the rotational speed
14/10 . . . characterised by changing the positions of the inlet or outlet openings with respect to the working chamber
14/12 . . . using sliding valves
14/14 . . . using rotating valves
14/16 . . . using lift valves
14/18 . . . characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings F04C 14/10)
14/185 . . . (by varying the useful pumping length of the cooperating members in the axial direction)
14/20 . . . by changing the form of the inner or outer contour of the working chamber
14/22 . . . by changing the eccentricity between cooperating members
14/223 . . . . . (using a movable cam)
14/226 . . . . . (by pivoting the cam around an eccentric axis)
14/24 . . . characterised by using valves controlling pressure or flow rate, e.g. discharge valves (or unloading valves) (F04C 14/10 takes precedence)
14/26 . . . using bypass channels
14/265 . . . . . (being obtained by displacing a lateral sealing face)
14/28 . . . Safety arrangements; Monitoring

15/00 Component parts, details or accessories of machines, pumps or pumping installations, not provided for in groups F04C 2000 - F04C 14/00

15/003 . . . (Sealing arrangements in rotary-piston machines or pumps (sealing in general F16))
15/007 . . . (Radial sealings for working fluid)
15/011 . . . . . (of rigid material)
15/015 . . . . . (of resilient material)
15/019 . . . . . (Radial sealing elements specially adapted for intermeshing-engagement type machines or pumps, e.g. gear machines or pumps)
15/023 . . . . . (Axial sealings for working fluid)
15/026 . . . . . (Elements specially adapted for sealing of the lateral faces of intermeshing-engagement type machines or pumps, e.g. gear machines or pumps)
15/03 . . . . . (Sealings for working fluid between radially and axially moving parts)
15/034 . . . . . (for other than the working fluid, i.e. the sealing arrangements are not between working chambers of the machine)
15/038 . . . . . (Shaft sealings specially adapted for rotary-piston machines or pumps)
15/042 . . . . . (Systems for the equilibration of forces acting on the machines or pump (interstice adjustment other than by fluid pressure F01C 21/102))
15/046 . . . . . (Internal leakage control)
15/049 . . . . . (Equalization of pressure pulses (silencing for compressors F04C 29/06))
15/053 . . . . . (Venting means for starting)
15/057 . . . . . (Driving elements, brakes, couplings, transmission specially adapted for machines or pumps (brakes, couplings, transmissions per se F16, B60))
15/061 . . . . . (Means for transmitting movement from the prime mover to driven parts of the pump, e.g. clutches, couplings, transmissions)
15/065 . . . . . (for eccentric movement)
15/069 . . . . . (Magnetic couplings)
15/073 . . . . . (Couplings between rotors and input or output shafts acting by interengaging or mating parts, i.e. positive coupling of rotor and shaft)
15/076 . . . . . (Fixing rotors on shafts, e.g. by clamping together hub and shaft)
15/08 . . . . . (Prime movers)
15/084 . . . . . (Brakes, braking assemblies)
15/088 . . . . . (Lubrication (of machines or engines in general F01M))
15/0092 . . . (Control systems for the circulation of the lubricant)
15/0096 . . . (Heating; Cooling (of machines or engines in general F01P))
15/06 . . . Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet
15/062 . . . [Arrangements for supercharging the working space (similar arrangements for internal combustion engines F02B 33/00, F02B 37/00)]
15/064 . . . [with inlet and outlet valves specially adapted for rotary or oscillating piston machines or pumps]
15/066 . . . [of the non-return type]
15/068 . . . [of the elastic type, e.g. reed valves]

18/00 Rotary-piston pumps specially adapted for elastic fluids (with fluid ring or the like F04C 19/00; rotary-piston pumps in which the working-fluid is exclusively displaced by one or more reciprocating pistons F04B)

NOTE
Group F04C 18/30 takes precedence over groups F04C 18/02 - F04C 18/28 and F04C 18/48 - F04C 18/56.

18/02 . . . of arcuate-engagement type, i.e. with circular translatory movement of co-operating members, each member having the same number of teeth or tooth-equivalents
18/0207 . . . [both members having co-operating elements in spiral form]
18/0215 . . . [where only one member is moving]
18/0223 . . . [with symmetrical double wraps]
18/023 . . . [where both members are moving]
18/0238 . . . [with symmetrical double wraps]
18/0246 . . . [Details concerning the involute wraps or their base, e.g. geometry]
18/0253 . . . [Details concerning the base]
18/0261 . . . [Details of the ports, e.g. location, number, geometry]
18/0269 . . . [Details concerning the involute wraps]
18/0276 . . . [Different wall heights]
18/0284 . . . [Details of the wrap tips]
18/0292 . . . [Ports or channels located in the wrap]
18/04 . . . of internal-axis type
18/045 . . . [having a C-shaped piston]
18/06 . . . of other than internal-axis type
18/063 . . . with coaxially-mounted members having continuously-changing circumferential spacing between them
18/067 . . . having cam-and-follower type drive
18/07 . . . having crankshaft-and-connecting-rod type drive
18/073 . . . having pawl-and-ratchet type drive
18/077 . . . having toothed-gearing type drive
18/08 . . . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
18/082 . . . [Details specially related to intermeshing engagement type pumps]
18/084 . . . [Toothed wheels]
18/086 . . . [Carter]

18/088 . . . [Elements in the toothed wheels or the carter for relieving the pressure of fluid imprisoned in the zones of engagement]
18/10 . . . of internal-axis type with the outer member having more teeth or tooth equivalents, e.g. rollers, than the inner member
18/103 . . . [with a crescent shaped filler element, located between the inner and outer intermeshing elements]
18/107 . . . with helical teeth
18/1075 . . . [the inner and outer member having a different number of threads and one of the two being made of elastic material, e.g. Moineau type]
18/113 . . . the inner member carrying rollers intermeshing with the outer member
18/12 . . . of other than internal-axis type
18/123 . . . [with radially or approximately radially from the rotor body extending tooth-like elements, co-operating with corresponding recesses in the other rotor, e.g. lobes, Roots type]
18/126 . . . [with radially from the rotor body extending elements, not necessarily co-operating with corresponding recesses in the other rotor, e.g. lobes, Roots type]
18/14 . . . with toothed rotary pistons
18/16 . . . [with helical teeth, e.g. chevron-shaped, screw type {for non-parallel axes of movement F04C 18/48}]
18/165 . . . [having more than two rotary pistons with parallel axes]
18/18 . . . with similar tooth forms (F04C 18/16 takes precedence)
18/20 . . . with dissimilar tooth forms (F04C 18/16 takes precedence)
18/22 . . . of internal-axis type with equidirectional movement of co-operating members at the points of engagement, or with one of the co-operating members being stationary, the inner member having more teeth or tooth equivalents than the outer member
18/24 . . . of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions
18/26 . . . of internal-axis type
18/28 . . . of other than internal-axis type
18/30 . . . having the characteristics covered by two or more of groups F04C 18/02, F04C 18/08, F04C 18/22, F04C 18/24, F04C 18/48, or having the characteristics covered by one of these groups together with some other type of movement between co-operating members
18/32 . . . having both the movement defined in group F04C 18/02 and relative reciprocation between the co-operating members
18/321 . . . [with vanes hinged to the inner member and reciprocating with respect to the inner member]
18/322 . . . [with vanes hinged to the outer member and reciprocating with respect to the outer member]
18/324 . . . with vanes hinged to the inner member and reciprocating with respect to the outer member
18/328 . . . and hinged to the outer member
18/332 . . . with vanes hinged to the outer member and reciprocating with respect to the inner member
18/336 . . . and hinged to the inner member
Rotary-piston pumps with fluid ring or the like, specially adapted for elastic fluids

NOTE

Multi-stage pumps or compressors with stages connected in series or in parallel are not considered as having complementary function.

NOTE

Multi-stage steam engines, motors, pumps or compressors with stages connected in series or in parallel are not considered as having complementary function.

Adaptations of pumps for special use of pumps for elastic fluids

Sealing arrangements in rotary-piston pumps specially adapted for elastic fluids
Control of, monitoring of, or safety arrangements for, pumps or pumping installations specially adapted for fluidics

- specially adapted for several pumps connected in series or in parallel
- specially adapted for reversible pumps
- specially adapted for stopping, starting, idling or no-load operation
- {Capacity control using a multiplicity of units or pumping capacities, e.g. multiple chambers, individually switchable or controllable}
- characterised by varying the rotational speed
- characterised by changing the positions of the inlet or outlet openings with respect to the working chamber
- using sliding valves
- {with sliding valves controlled by the use of fluid other than the working fluid}
- using rotating valves
- using lift valves
- characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings F04C 28/10)
- {by varying the useful pumping length of the cooperating members in the axial direction}
- by changing the form of the inner or outer contour of the working chamber
- by changing the eccentricity between cooperating members
- characterised by using valves controlling pressure or flow rate, e.g. discharge valves (or unloading valves) (F04C 28/10 takes precedence)
- using bypass channels
- {being obtained by displacing a lateral sealing face}
- Safety arrangements; Monitoring

Component parts, details or accessories of pumps or pumping installations, not provided for in groups F04C 18/00 - F04C 28/00

- {Injection of a fluid in the working chamber for sealing, cooling and lubricating (sealing only F04C 27/00; lubrication only F04C 29/02; cooling F02B 7/02, F02D 21/00, F02M 25/00)}
- {with control systems for the injection of the fluid}
- {Systems for the equilibration of forces acting on the pump (interstice adjustment other than by fluid pressure F01C 21/102)}
- {Internal leakage control}
- {Equalization of pressure pulses (silencing F04C 29/06)}
- {Driving elements, brakes, couplings, transmissions specially adapted for pumps (brakes, couplings, transmissions per se F16, B09)}
Manufacture

NOTE
Manufacture comprises also treatment, assembly or disassembly methods, repairing, handling or the like.

Component

Application

2220/00

2220/50

Pumps with means for introducing gas under pressure for ballasting

2220/10

by removing material

2220/101

by electrochemical methods

2220/102

by spark erosion methods

2220/103

using lasers

2220/20

essentially without removing material

2220/21

by casting

2220/22

by sintering

2220/23

by permanently joining parts together

2220/231

by welding

2220/234

by extrusion

2220/235

by forging

2220/236

by rolling

2220/237

by hydroforming

2220/230

Heat treatment

2220/231

Hardening; Annealing

2220/236

Assembly methods

2220/230/61

Adjustment

2220/230/62

Gap; Clearance

2220/230/63

Centering; Aligning

2220/230/64

Mounting devices for pumps or compressors

2220/230/65

Balancing

2220/230/70

Disassembly methods

2220/230/80

Repairing methods

2220/85

Methods for improvement by repair or exchange of parts

2220/90

Improving properties of machine parts

2220/91

Coating

2220/92

Surface treatment

2240/00

Components

2240/10

Stators

2240/102

with means for discharging condensate or liquid separated from the gas pumped

2240/20

Rotors

2240/30

Casings or housings

2240/40

Electric motor

2240/401

Linear motor

2240/402

Plurality of electronically synchronised motors

2240/403

with inverter for speed control

2240/45

Hybrid prime mover

2240/50

Bearings

2240/51

for cantilever assemblies

2240/52

for assemblies with supports on both sides

2240/54

Hydrostatic or hydrodynamic bearing assemblies specially adapted for rotary positive displacement pumps or compressors

2240/56

Bearing bushings or details thereof

2240/60

Shafts

2240/601

Shaft flexion

2240/603

with internal channels for fluid distribution, e.g. hollow shaft
### F04C

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<td>Shaft sleeves or details thereof</td>
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<td>Balance weight, counterweight</td>
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<td>2240/808</td>
<td>Electronic circuits (e.g. inverters) installed inside the machine</td>
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<td>Sensor, e.g. electronic sensor for control or monitoring</td>
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<tr>
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<td>Actuator for control, e.g. pneumatic, hydraulic, electric</td>
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#### 2250/00 Geometry

- 2250/10: of the inlet or outlet
- 2250/101: of the inlet
- 2250/102: of the outlet
- 2250/20: of the rotor
- 2250/201: conical shape
- 2250/30: of the stator
- 2250/301: compression chamber profile defined by a mathematical expression or by parameters

#### 2270/00 Control; Monitoring or safety arrangements

- 2270/01: Load
- 2270/015: Controlled or regulated
- 2270/02: Power
- 2270/025: Controlled or regulated
- 2270/03: Torque
- 2270/035: Controlled or regulated
- 2270/04: Force
- 2270/041: Controlled or regulated
- 2270/042: radial
- 2270/0421: Controlled or regulated
- 2270/0422: centrifugal
- 2270/04225: Controlled or regulated
- 2270/044: axial
- 2270/0445: Controlled or regulated
- 2270/05: Speed
- 2270/051: Controlled or regulated
- 2270/052: angular
- 2270/0525: Controlled or regulated
- 2270/054: linear
- 2270/0545: Controlled or regulated
- 2270/06: Acceleration
- 2270/065: Controlled or regulated
- 2270/07: Electric current
- 2270/075: Controlled or regulated
- 2270/08: Amplitude of electric current
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- 2270/12: Vibration

- 2270/125: Controlled or regulated
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- 2270/42: Conditions at the inlet of a pump or machine
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- 2270/54: Conditions in a control cylinder/piston unit
- 2270/56: Number of pump/machine units in operation
- 2270/58: Valve parameters
- 2270/585: Controlled or regulated
- 2270/60: Prime mover parameters
- 2270/605: Controlled or regulated
- 2270/70: Safety, emergency conditions or requirements
- 2270/701: Cold start
- 2270/72: preventing reverse rotation
- 2270/78: Warnings
- 2270/782: Sound
- 2270/784: Light
- 2270/80: Diagnostics
- 2270/86: Detection
- 2270/90: Remote control, e.g. wireless, via LAN, by radio, or by a wired connection from a central computer

#### 2280/00 Arrangements for preventing or removing deposits or corrosion

- 2280/02: Preventing solid deposits in pumps, e.g. in vacuum pumps with chemical vapour deposition [CVD] processes
- 2280/04: Preventing corrosion