说明书
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1LE0 低压交流异步电动机

安装与维护手册
Installation and Maintenance Manual

siemens.com.cn/SIMOTICS_GP_1LE0

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简介 1

1.1 应用范围

1LE0 标准电机的防护等级达到 IEC60034-5 标准中 IP55 防护等级的要求（见铭牌标注）， 适用于灰尘及潮湿的工作环境 。

如果电机安装或储存于户外 ，有必要增加相应的防护装置 ，以避免受长期强烈的阳光暴晒 、雨水的侵蚀、以及冰雪和灰尘对电机造成的影响。

（相关使用环境条件如下：

- 海拔高度 ≤ 1000 m
- 环境温度 +40 °C
- 操作环境温度 -20 °C ~ +40 °C
- 相对湿度

环境温度	相对湿度
-20 °C ≤ T ≤ 20 °C	100 %
20 °C < T ≤ 30 °C	95 %
30 °C < T ≤ 40 °C	55 %

注 ：如果使用环境条件和以上不一样，请咨询西门子。

本系列 2 极，4 极，6 极，8 极电机符合 GB18613-2020《中小型三相异步电动机能 效限定值及能效等级》标准，具体规格的能效标准对应如下：

1LE0003/1LE0303是3级能效，1LE0004/1LE0304是2级能效，或者具体能效可以参见铭牌。

其中选项 F70、选项 F90、频率 60Hz 及船用电机不在 GB18613 标准范围内，电机铭牌上不标注能效信息。

1.2 冷却方式

自冷却方式（标准配置）： 冷却方式 IC411 ，符为合 IEC/EN 60034-6 标准要求。

1LE0 电机为全封闭自冷却（双向风扇）型式电机，在使用时确保电机具有足够的冷却风量。如果使用可选外部风扇，必须在安装风扇时确保合适的冷却风向。

强制冷却方式（选件）： 冷却方式为 IC416，满足 IEC/EN 60034 标准要求。

电机冷却是通过一个独立的风扇（强制通风）而实现的。这种强制冷却不受机器运行状态的影响。

注意

- 确保独立风扇气流通畅，且与周围环境气流方向一致；
- 独立风扇须由一个独立电源模块供电，并且确保风扇的转向与其风扇罩上附带的转向标志指示的方向一致；
- 独立风扇不能通过变频器驱动；
- 电机启动前，先启动独立风扇，然后启动电机；电机停机时，先关闭电机电源，待电机停止运行后断开独立风扇驱动电源。

1.3 安装结构型式

电机铭牌上标出了其安装结构型式。

！ 警告

在运输过程中，电机须通过吊环或指定的部位进行吊装搬运。

基本安装类型	示意图	适用范围（机座号）	其他安装类型	示意图	适用范围（机座号）
IM B3 (IM 1001)		FS 80~355	IM V5 (IM 1011)		FS 80~315
			IM V6 (IM 1031)		FS 80~315
			IM B6 (IM 1051)		FS 80~315
			IM B7 (IM 1061)		FS 80~315
			IM B8 (IM 1071)		FS 80~315

基本安装类型	示意图	适用范围（机座号）	其他安装类型	示意图	适用范围（机座号）
IM B5 (IM 3001)		FS 80~315	IM V1 (IM 3011)		FS 80~355
			IM V3 (IM 3031)		FS 80~315
IM B14 (IM 3601)		FS 80~160	IM V18 (IM 3611)		FS 80~160
			IM V19 (IM 3631)		FS 80~160
IM B35 (IM 2001)		FS 80~355	IM V15		FS 80~315

注：1）铝壳电机机座号范围为 FS80~160。

2）对于其他特殊的安装结构型式，请咨询西门子。

搬运及存储

2

在运输电机时，必须使用所有吊环来搬运。在搬运电机之前，请确保吊环安装正确且牢固，但切勿使用电机轴和风扇罩来搬运电机。另外，电机升降时必须注意避免摇摆和震动，以防造成轴承受损。

如果电机配有转子固定装置，则在运输电机时始终应使用该装置。在整个运输期间它都必须保持固定不能发生移动。如果客户已经加装了一些零件，例如联轴器或者带轮，则轴承在运输过程中有可能会损坏。在这种情况下需要客户自行准备转子固定装置。

建议所有的电机应该储存在干燥无尘的环境之下，并避免过多的震动。

电动机存放时不允许堆码。对于有包装箱的电机，按照包装箱上的标识操作。

2.1 室外存放

选择水平、不会摇晃且干燥的存放位置。如果按照存放要求是必要的，请在存放前修复损坏的包装。将电机、设备和包装箱放置在底架、大方木料或基座上，以防止地面湿气。防止电机陷入地下。

防潮用的盖布或防雨布不得与所存放物品的表面接触。放置间隔板垫，以确保足够的空气循环。

2.2 室内存放

应防止受极端天气的影响，储藏室应保持干燥、通风良好并且防尘、防冻、防撞、抗震。

2.3 金属裸露表面

考虑到运输已对裸露部分（如轴端、法兰表面、中心边缘）进行了临时的防腐处理（< 6 个月）。长期存放时，须采取适当的防腐措施。

电机已根据订货时要求的温度范围采用了最佳的材料。指定的温度范围请见铭牌。

！ 警告

如果电机没有采取任何保护措施而在室外使用或存放，会导致电机损坏。

- 避免电机受强烈阳光照射、雨雪、冰雹或灰尘的侵蚀。
- 在户外或湿度大的环境中存储电机可能导致电机零部件生锈。
- 必要时请咨询服务中心或者遵循户外使用电机的技术条件。

2.4 存放温度

允许的温度范围：-20 °C 到 +50 °C

允许的最大空气湿度：60 %

对于因环境温度而对运行状态或海拔有特殊规定的电机，其存放温度需要遵守其他条件。此时请参照电机铭牌上的环境温度和海拔的说明。

2.5 存放时间

每半年必须至少旋转一次电机轴，避免振蚀。长期存放会降低轴承的润滑使用寿命。

2.6 开放型轴承

- 存放超过 12 个月时，应对开放型轴承的润滑脂进行检查。
- 如果检查时发现润滑脂耗尽或受污染，必须立即更换润滑脂。冷凝水渗入会改变润滑脂粘稠度。

2.7 密封型轴承

- 密封型轴承存放超过 24 个月时，应更换驱动端和非驱动端轴承。

如果电机在灰尘及湿度较大环境下存储时间超过 2 年，电机的使用寿命将会降低。对于这种情况，必要时在电机安装和启动前，对其绝缘系统进行检测，从而保证其可以正常稳定的运行（相关参考值，见 3.5）。

电机加工表面（法兰表面，轴端表面等）已在工厂进行防腐蚀处理，但是在电机储存时仍需做必要的防腐措施。建议经常转动一下电机轴，使轴承润滑脂分布均匀，同时避免产生静态压痕。

调试 3

⚠ **警告**

所有工作都必须由熟练工人进行操作。电机做任何操作工作之前，确保电机与主线及辅助电源断开。并且确保电源不被意外开启。

3.1 安装

良好的基础与正确的安装是将来电机长期可靠运行的基本条件。基础不良或者安装不当，会造成异常的电机振动和噪音。

3.1.1 基础要求

电机安装的基础可以是金属底座，也可以是混凝土结构的平台，无论是何种结构基础都应有足够的强度与刚性支撑电机。

基础的设计可以参考 DIN4024。

支撑电机的基础表面必须是平面，常用电机支撑平面的平面度：

机座号 (FS)	平面度（mm）
≤ 132	0.10
160	0.15
≥ 180	0.20

3.1.2 安装要求

由于机械部件制造公差及累积误差的存在，电机底脚安装平面与基础安装的接触平面之间，可能存在间隙。

安装时，应仔细用塞尺测量此间隙值。对于 >0.05 mm 的间隙，应插入合适的填隙片。填隙片的尺寸根据实际的间隙值配做。

插入合适厚度的填隙片

3.1.3 电机安装完毕后必须将吊环拧紧

当电机竖直安装且电机轴驱动端向下时，建议在非驱动端增加防护罩，从而可以避免水及其他外部物体进入风扇罩，从而影响电机散热。

3.1.4

当电机竖直安装且驱动端轴朝上安装，建议做必要的防护措施，以防止液体沿电机轴进入电机。

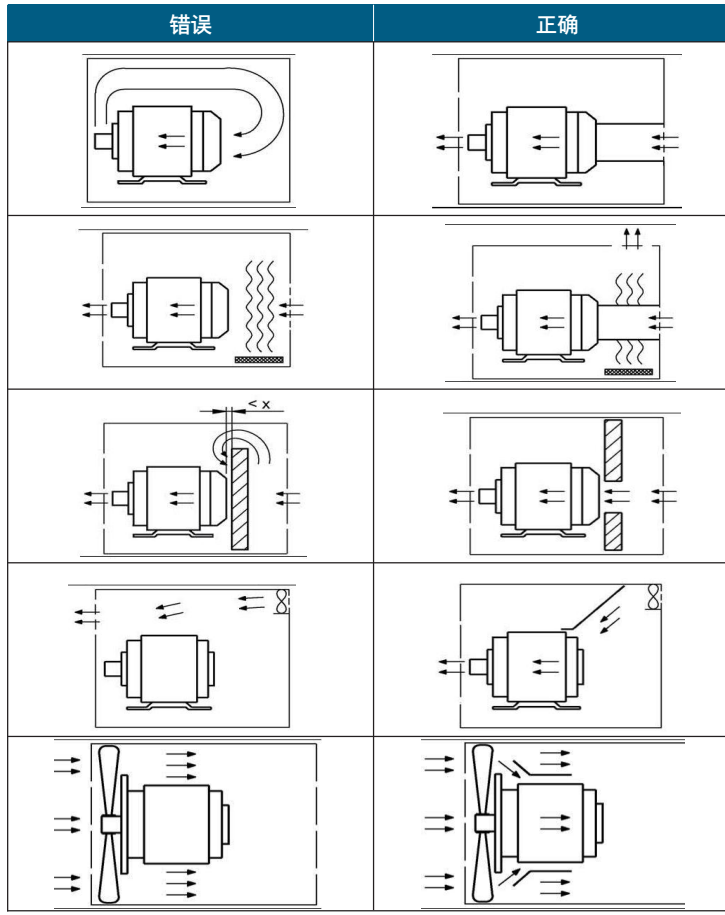
3.1.5 确保合理的冷却

⚠ **警告**

如果不注意以下几点说明，可能会造成财产损失、重伤或死亡。

- 切勿阻碍通风。
- 应防止临近机组的废气被直接吸入。
- 对进风口朝上的垂直安装电机，应防止异物和水从进风口进入。
- 对于轴端向上的电机，应防止液体沿轴端流入电机。

对于带有外部风扇的电机，请对电路进行设计以防止在外部风扇未运行时接通并运行主电机。



电机进风口与相邻模块的最小间距“X”尺寸见下表

机座号	X mm
80 ... 100	20
112	25
132	30
160	40
180 ... 200	90
225 ... 250	100
280 ... 315	110
355	140

3.2 接线盒

接线盒安装于电机顶部或侧面（左侧或右侧）， 可以作 4 × 90° 方向旋转，便于电缆多角度引入。

3.3 动平衡与联结

为了确保安静、无振动的运行环境，对传动联结件（联轴器、滑轮、风扇、变速器等）须进行适当的轴向、径向校正。

1LE0 电机转子动平衡方式为半键平衡。动平衡方式在电机铭牌上有标注（H 表示半键平衡）。

注意

- 为确保无振动运行，传动联结件的动平衡方式为半键平衡；
- 在调整传动联结件配合过程中，须考虑联结件与电机的温度环境；
- 当电机启动前没有联结任何传动件时，电机轴上的键必须移除。

3.4 电气连接

⚠ 警告

所有工作都必须由熟练工人进行操作。电机做任何操作工作之前，确保电机与主线及辅电源断开。并且，确保电源不被意外开启。

通常电机的接线盒内都有六个电源线接线端子和一个接地端子，其中机座号为 FS315 ~ 355 的电机机壳上还有另外一个接地端子。所有电机都适合双向转动（正转或者反转），通过改变电源的相序即可改变电机转向。

电源连接

1LE0 三相异步电动机线圈可连接成星形、三角形。

允许电压偏差为± 5%，频率偏差为± 2%。

电缆连接示例	电机机壳外接地	

关于接线端子的拧紧力矩，请参照表 1 中接线端子拧紧力矩大小以及方向。

关于电机机壳外接地螺栓和接线盒内接地螺栓规格，请参见表 2。

表 1

	尺寸	M4	M5	M6	M8	M10	M12	M16
	转距（Nm）	1.2	2.5	4.0	8.0	13	20	40

注：拧紧力矩（Nm，公差：± 10%）

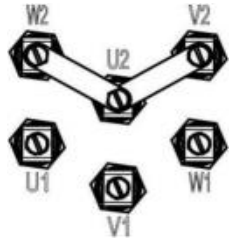
表 2

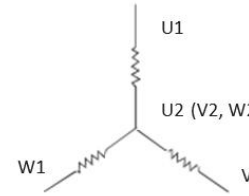
机座号	80-180	200	225-315	355
机壳外部接地螺栓规格	M6	M6	M8	M8
接线盒内接地螺栓规格	M5	M6	M6	M10

注：1LE0303/1LE0304-160 接线盒内接地螺栓规格M6

星形连接

星形连接是通过绕组接线端子 W2、U2 及 V2 相互连接，U1、V1、W1 端连接电源而实现，如下图所示

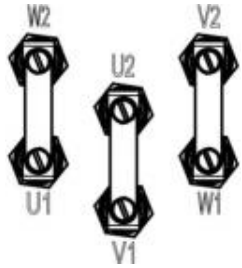


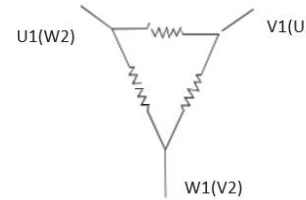


具体接法见电机铭牌

三角形连接

三角形连接是通过三相绕组的端子首尾依次相接而实现，如下图所示





具体接法见电机铭牌

注：若接线盒的辅助或主进线孔由葛兰密封，需要用标准的扳手来拧开。

绕组保护

1LE0 电机有三种形式的绕组保护：（电机编号的第 15 位字母）

- 热敏电阻 PTC、测温电阻 PT100&PT1000 — 用于绕组测温时，报警温度建议设定为 145 °C，跳闸温度建议设定为 155 °C。
- 测温电阻 PT100 — 用于轴承测温时，报警温度建议设定为 95 °C，跳闸温度建议设定为 105 °C。

注意

PTC 热敏电阻和 PT100 以及 PT1000 测温电阻都需要与外部控制单元进行联结。

当 PT100 测温电阻用于轴承温度监测时，报警和跳闸温度设定值与绕组测温的温度设定值不同。

辅助接线端子

如电机配置 PTC，PT100，PT1000 和防潮加热带，其引线端标识如表 2 所示。

表 2

一组三芯 串联的 PTC	第 15 位为 B	2TP1
		2TP2
两组三芯 串联的 PTC	第 15 位为 C	1TP1
		1TP2
		2TP1
		2TP2
一个单支 两线制 PT1000	第 15 位为 k	1R1
		1R2
两个单支 两线制 PT100	Q72	10R1
		10R2
		11R1
		11R2
三个单支 两线制 PT100	第 15 位为 H	1R1
		1R2
		2R1
		2R2
		3R1
		3R2
防潮加热带	Q04	1HE1
		1HE2

六个单支 两线制 PT100	第 15 位数为 J	1R1
		1R2
		2R1
		2R2
		3R1
		3R2
		4R1
		4R2
		5R1
		5R2
		6R1
		6R2
三个单支 三线制 PT100	15 位数为 Q	1R1
		1R1
		1R2
		2R1
		2R1
		2R2
		3R1
		3R1
		3R2
六个单支 三线制 PT100	15 位数为 R	1R1
		1R1
		1R2
		2R1
		2R1
		2R2
		3R1
		3R1
		3R2
		4R1
		4R1
		4R2
		5R1
		5R1
		5R2
		6R1
		6R1
		6R2

注：对于使用 2 个 PTC 的，端子 1TP1、1TP2 用于报警，2TP1、2TP2 用于跳闸。在温差比较大的环境中，电机停止一段时间容易产生凝固水。因此，强烈建议在这种情况下为电机加选防潮加热带（选件号：Q04）。

！ 警告

防潮加热带切勿在电机运转时加热。

3.5 检查绝缘电阻

在初次启动电机前或者经过长时间（6 个月）停机后，建议在开启电源启动之前对相位间的绝缘电阻进行测量。

！ 警告

绝缘电阻测量完成后的短时间内，接线端子还可能带有一定的危险高电压，请勿直接触摸。

绝缘电阻

最小绝缘电阻：新电机或绕组维修后的电机对地电阻为 10 M Ω。 临界电阻：临界电阻的计算方法为额定电压乘以系数，如额定电压 690 V 电机临界电阻可计算如下临界电阻 = 0.69 kV × 0.5 M Ω /kV = 0.345 M Ω。

测量方法

最小绝缘电阻的测量：绕组对地电阻的测量可以通过对绕组施加 500 V 直流电压来测量，绕组温度需保证在 25 ℃ ± 15 ℃。

临界电阻的测量：临界电阻的测量必须在电机运行温度的情况下对绕组施加 500 V 直流电压。

常见的绝缘电阻故障原因及处理方式主要有如下 2 种情况。

故障原因 1：可能是由于环境潮湿引起的

处理措施 1：需要将绕组进行烘干处理。

故障原因 2：电机经过长时间运行后（电机处于热态状态），最小电阻值可降低。

处理措施 2：如果测量值低于临界电阻值，必须对电机进行更换或修理。

3.6 温度检测

温度是电机运行时的重要参考指标，得到电机各重要部位的实时温度，对掌握电机的运行状态、有效预防电机故障、保证电机可靠运行十分重要。

电机温度受冷却介质和环境温度的影响。对电机绕组温升的测量，通常是预埋测温元件（如 PT100），测温元件通过引出线连接控制系统，对电机进行测温，或者使用高精密的电阻法进行推算。如需测量电机机壳表面温度，应采用专门的仪器（如红外测温仪）进行测量，测量位置一般在电机吊环孔位置或电机中间位置。

3.7 变频器应用

！ 警告

转矩不稳定的负载（如活塞式压缩机负载）， 必然会导致非正弦电流，该电流的谐波会对系统造成影响，产生过多干扰。

电磁兼容性

当变频器驱动电机时，电磁干扰的程度取决于变频器的类型（种类，IGBT 数量，干扰控制措施及制造商）、 布线、距离以及应用需求。

在设计和应用阶段必须参考变频器制造商关于电磁兼容性的安装指导。

！ 警告

如果使用变频器驱动电机，转速超过电机额定转速时，必须考虑对电机的机械零部件及传动联结件的影响。

更多内容，请参考 IEC 60034-1。

噪声，温升和振动

电机在变频运行时，电机噪声、温升将会有所增加。

变频应用时，可能会由于转速高于额定转速，电机机械振动加大，从而使机械运转的平稳性发生变化。这样也会导致轴承和润滑脂的寿命降低。

变频使用时，为了避免轴电流造成电机轴承损坏，推荐选用绝缘轴承选项（选件号 L27）。

维护 4

⚠ **警告**

对电机进行维护操作前，电机必须对主电路以及相关的辅助电路。

“5 项安全规则”（如在 DIN VDE 0105 中规定的）如下：

- 设备与电源隔离
- 采取有效措施防止再次连接
- 确认设备停止运行
- 确保电机正确接地
- 隔开相连的运动部分

以上所列的规则应一直保持到所有电机维修维护工作全面结束，并组装完成。

4.1 轴承寿命

在正常运行条件下，电机水平安装且不受任何轴向力的情况下，电机轴承寿命至少可达到 40.000 小时；在电机承受允许的径向和轴向载荷时，电机轴承寿命至少可达 20.000 小时。这里所说的 20.000 或 40.000 小时指的是，电机在环境温度不超过 40 °C，按电机铭牌上标定的数据正常运转的情况下可达到的寿命。

注意

- 环境温度超过 40 °C 后，每升高 10 °C，润滑脂的寿命缩短一半。
- 电机在垂直安装、外界环境非常恶劣、受外部机械振动或处于湿度比较大的环境中运行时，润滑油脂的寿命以及轴承的寿命将会缩短。
- 长期的储存会降低轴承的寿命，电机在长期储存超过 24 个月时，驱动端和非驱动端的封闭式轴承需要更换，开放式轴承需要重新注油。
- 若电机装配开放式轴承，须按 4.2 部分中提到的润滑时间间隔进行定期注油。

！ 警告

电机长期变频高速运转会将降低轴承和润滑脂的寿命。

4.2 润滑脂类型

润滑脂类型：UNIREX N3（Esso）， 合成润滑脂符合 DIN 51825-K3N 规定。

配有特殊注油装置的电机，注油信息打印在铭牌上或在风扇罩上贴加油标签。

！ 注意

不同品牌和型号的润滑脂不得混加。

4.3 润滑脂寿命和再润滑周期

机座号 FS80~90 的电机，在轴承寿命期内润滑脂无需更换。

机座号 FS100 ~ 250 的电机，当电机运行在额定电压和频率下、环境较好的条件下时，在轴承寿命期内润滑脂无需更换。但当电机运行在环境比较恶劣的情况下时，建议用户选择添加注油装置（选件号为 L23）， 再润滑周期见表 3。

机座号 FS280 ~ 355 的电机标准配置带注油装置，再润滑周期见表 3。

表 3

极数	机座号	持久润滑型轴承的润滑脂	可再润滑型轴承的润滑脂	再润滑周期（小时）	加注油脂量（克）
2,4,6	80-90	标配	-/-	-/-	-/-
2,4,6	100-112	标配	选项 (L23)	8000h	10g
2,4,6,8	132-160	标配	选项 (L23)	8000h	15g
2	180-250	标配	选项 (L23)	4000h	20g
4,6,8	180-250	标配	选项 (L23)	8000h	20g
2	280	-/-	标配	3000h	30g
4,6,8	280	-/-	标配	5000h	30g
2	315	-/-	标配	3000h	40g
4,6,8	315	-/-	标配	5000h	40g
2	355	-/-	标配	3000h	40g
4,6,8	355	-/-	标配	4000h	60g

注意：1,如果电机垂直安装、运行时存在较大振动、有负载突变的情况或者经常 变向操作，应该在比更短的时间内更换润滑脂。2,1LE0004-315 2P 加注油脂量为30g。4,6,8P再润滑周期为4000h。

4.4 再润滑

！ 警告

在电机运行过程中或停止状态进行注油时，必须遵守当地关于安全操作的相关规定！

！ 注意

添加润滑油脂时，注意不能加过多的润滑油脂，否则将导致轴承温度过高。添加润滑油脂过程中，切勿将灰尘或旧润滑油脂进入到轴承中。

注意

在添加润滑脂之前，需要将注油孔中的旧润滑脂清理干净。对于废旧的润滑脂应妥善处理，以防污染环境。

注意

为避免电机添加过量润滑脂，在添加润滑脂前，应打开排油塞。添加完成后，应让电机运转一段时间，确定排油孔无润滑脂流出，再装上排油塞。

建议在电机运行过程中保持工作温度时，进行添加润滑脂。

若在电机运行过程中不能添加润滑脂，推荐先注入少量润滑脂，然后旋转电机使润滑脂均匀分布，当电机停下后，将剩余的润滑脂再注入。

如果电机轴驱动端轴承或非驱动端轴承过热，建议检查轴承热损情况，如有必要，则需更换轴承或添加润滑脂。

注意

如果过热，轴承脂颜色将会变暗。

4.5 轴承更换 — 装配与拆卸

当轴承寿命终了时，电动机运行的振动及噪声将明显增大，检查轴承的径向游隙，如达到表 4 中的数值应立即更换轴承。

表 4

电机机座号	80~112	132~160	180~250	280~355
轴承内径	20~30	35~50	55~80	85~120
极限磨损游隙	0.1	0.15	0.2	0.3

注意

更换新轴承的规格型号应与旧轴承一致。

拆下电机的必要部分，用专业的工具将滚动轴承拉出。

在安装新的轴承之前，首先按照轴承生产商提供的相关说明对轴承进行预热，然后将轴承套在转子轴上。轴承更换后，旧轴封（V 型环或油封）也必须更换。

！ 警告

更换轴承时，严格禁止任何击打和冲击（例如用锤头等），以防损害轴承。

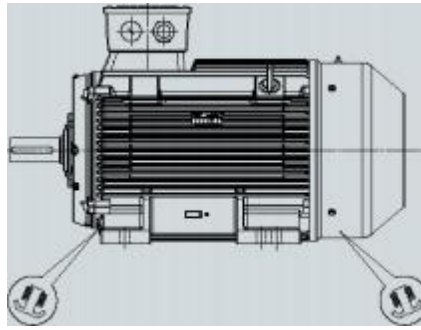
关于端盖和法兰盘上螺栓的拧紧力，请参照表 5 中的拧紧力矩大小及方向。

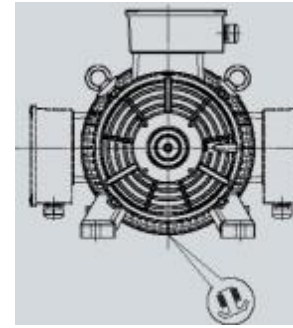
尺寸	M4	M5	M6	M8	M10	M12	M16	M20
转距（Nm）	2	3.5	6	16	28	46	110	225

注：拧紧力矩（Nm，公差：± 10%）

4.6 排水孔

根据安装结构型式（电机编号第 14 位字母），排水孔位于电机机座或端盖上，并且排水孔在出厂时预先安装好塑料塞。关于排水孔的位置，如下图所示：





启动

5

预备检查

在电机第一次通电前，建议预先做以下几个方面的检查：

- 确保螺栓拧紧，包括传动联结件上的螺栓；
- 确保电机冷却风扇没有被卡住；
- 若电机配有注油孔，确保轴承具有充分润滑油脂；
- 确保电源以及接线方式与铭牌标出直接启动、软启动或变频器启动的数据一致。
- 确保电机正确接地；
- 若电机装配有热保护电阻或防潮加热带，确保这些器件的端子接线正确。

当电机接通电源后，确保检查电机的转向以及空气流通方向是否正确，以及电流、振动和噪声是否正常。

REACH 法规第 33 条的规定

该产品的一个或多个组成物品中含有高关注物质候选清单中的以下物质超过 0.1%：

- CAS 编号 7439-92-1，铅

基于现有信息，在规范化使用的条件下，包括废弃处理，该物质不会产生风险。任何未经授权的改装、拆卸、及非西门子授权的维修等情形将可能导致无法获得保修资格。

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INTRODUCTION 1

1.1 Application scope

Prescribed use of 1LE0 standard motors according to IEC 60034-5: The standard motors are provided with degree of protection IP55 and can be used in a dusty and damp environment.

A suitable canopy cover is recommended if the motors are installed outdoors with exposure to direct sunlight, rain, snow and ice.

Please refer to the following environmental application conditions.

- Installation Altitude ≤ 1000 m
- 环境温度 +40 °C
- Ambient temperature -20 °C ~ +40 °C
- Relative Humidity

Ambient temperature	Relative Humidity
-20 °C ≤ T ≤ 20 °C	100 %
20 °C < T ≤ 30 °C	95 %
30 °C < T ≤ 40 °C	55 %

If the ambient conditions and site altitude is different from the above mentioned, please consult with Siemens.

1LE0 2P,4P,6P,8Pseries motors comply with GB18613《Minimum allowable values of energy efficiency and the energy efficiency grades for small and medium three-phase asynchronous motors》, the efficiency standard and the value of energy efficiency are：1LE0003/1LE0303 series motors are grade 3，1LE0004/1LE0304 series motors are grade 2，and the value of energy efficiency are shown on rating plate. Beside, the motor with option code F70 or F90 or 60Hz or marine motor without GB18613 on nameplate.

1.2 Motor construction and types

Self-ventilation (standard): Type of cooling IC411 in accordance with IEC / EN 60034-6.

1LE0 motors are totally enclosed and self-ventilated (TEFC) by a bi-directional fan mounted on the NDE of the rotor shaft. Care must be taken to ensure adequate clearance for maximum air flow and cooling. If the optional external fan is used, the correct direction of air flow must be taken into consideration for proper cooling.

Forced ventilation (optional): Type of cooling IC416 in accordance with IEC / EN 60034-6 Cooling independent of the motor is achieved by means of a separately driven fan wheel (forced ventilation).

Forced ventilation is independent of the operating state of the machine.

Notice

- Ensure the air flow of the separately drivenfan smooth, and consistent with external air flow;
- The separately driven fan is powered by an independent module. And it must be ensured that the rotation direction of the separately driven fan is consistent with the mark shown on fan cowl;
- The separately driven fan cannot be powered through converter;
- It must be ensured that the machine is not operated without starting the external fan, and stopped before external fan stop.

1.3 Types of construction/method of installation

The type of construction of the machine is stated on the rating plate.

Warning

During transport, machines may only be hoisted in a position corresponding to their basic type of construction.

Basic type of construction code	Graphics-Based Representation	Application Scope (Frame size)	Other methods of installation	Graphics-Based Representation	Application Scope (Frame size)
IM B3 (IM 1001)		FS 80~355	IM V5 (IM 1011)		FS 80~315
			IM V6 (IM 1031)		FS 80~315
			IM B6 (IM 1051)		FS 80~315
			IM B7 (IM 1061)		FS 80~315
			IM B8 (IM 1071)		FS 80~315
IM B5 (IM 3001)		FS 80~315	IM V1 (IM 3011)		FS 80~355
			IM V3 (IM 3031)		FS 80~315
IM B14 (IM 3601)		FS 80~160	IM V18 (IM 3611)		FS 80~160
			IM V19 (IM 3631)		FS 80~160
IM B35 (IM 2001)		FS 80~355	IM V15		FS 80~315

注：1）The frame size of aluminum housing motor is FS80~160.

2）Other special construction and installation types, please consult with Siemens.

HANDLING AND STORAGE 2

When lifting the motors, always use all the lifting eyes provided. Prior to lifting the motor make sure that the lifting eyes are installed correctly and tightened. Never lift a motor using the motor shaft and fan cowling. In addition, care must be taken during lifting and lowering of the motor to avoid any shocks or vibrations which can result in bearing damages.

If the machine is fitted with a rotor shipping brace, this should always be used when transporting the machine.The rotor shipping brace must be attached during the transport. If the customer already has mounted parts, such as a coupling or belt pulley, the bearings can be damaged during transport. In this case, make sure that the customer uses a rotor shipping brace.

It is recommended that all motor be stored in a dry, dust free environment and free of excessive vibrations.

Do not stack motors during storage. For motors with packages, follow the instructions and markings on the package.

2.1 Storing outdoors

Choose a dry storage location which is safe from flooding and free from vibration. Repair any damage to the packaging before putting the equipment into storage if this is necessary to ensure proper storage conditions. In order to ensure protection against ground moisture, locate machines, equipment and crates on pallets, wooden beams or foundations. Prevent equipment from sinking into the ground. Do not impede air circulation under the stored items.

Covers or tarpaulins used to protect the equipment against the weather must not come into contact with the surfaces of the equipment. Use wooden spacer elements to ensure that air can circulate freely around the equipment.

2.2 Storing indoors

The storage rooms must provide protection against extreme weather conditions. They must be dry, free from dust, frost and vibration and well ventilated.

2.3 Bare metal surfaces

For transport, the bare surfaces (shaft ends, flange surfaces, centering edges) should be coated with an anti-corrosion agent which will last for a limited amount of time (<6 months). Apply suitable anticorrosion measures for longer storage times.

The materials used are specially designed for the temperature range required by the customer. The relevant temperature limits are specified on the rating plate.

! Warning

The motor can be damaged if you use it or store it unprotected outdoors.

- Protect the motor against intensive solar radiation, rain, snow, ice and dust.
- Storing the motor outdoors or in a high humidity environment may cause the motor parts to rust.
- If required, contact the service center, or technically coordinate outdoors.

2.4 Storing temperature

Permissible temperature range: -20 °C to +50 °C

Maximum permissible air humidity: 60 %

For machines that have a special design regarding the ambient temperature in the operating state or the installation altitude, other conditions could apply regarding the storage temperature. In this case, refer to the machine rating plate for data on the ambient temperature and installation altitude.

2.5 Storing time

Turn the shaft once every year to avoid bearing brinelling. Prolonged storage periods reduce the useful life of the bearing grease (aging).

2.6 Opening bearing

- For open bearings, e.g., 1Z, check the status of the grease when stored for longer than 12 months.
- Replace the grease if it is identified that the grease has lost its lubricating properties or is polluted. The consistency of the grease will change if condensation is allowed to enter.

2.7 Closed bearings

- For closed bearings, replace the DE and NDE bearings after a storage time of 24 months.

After 2 years of storage, for sealed-type bearing, it is recommended to replace bearings; for the motor with re-greasing device, please replace bearing grease.

The service life of the motor can be considerably reduced if the storage period extends beyond 2 years in environments with high moisture and dirt. If necessary, the insulation resistance of the winding could be measured determine the health of the motor prior to installation and start-up, (see Section 3.5. for reference values).

Machined surfaces (flange, DE rotor shaft) are treated at the factory with an anti-corrosive agent to prevent rusting. However these surfaces should be retreated during storage as deemed necessary. It is recommended to rotate motor's shaft regularly to ensure grease distribution, and to prevent static impression on bearing rings.

INSTALLATION AND COMMISSIONING

3

! Warning

All work must be carried out by a skilledworker.Before starting any work, be sure to isolate the machine from the main and auxiliary power supply as applicable.Mains must be secured against accidental switch on.

3.1 Installation

A fine foundation and exact installation is regarded as a basic requirement for coming long-time reliable working. Inappropriate foundation or installation may cause abnormal motor vibration and noise.

3.1.1 Foundation requirement

The foundation of installation can be a metal base or a platform of concrete structure, whatever structure the foundation has, the foundation must have enough strength and rigidity in order to support motors.

The design of foundation can refer to DIN 4024.

The supporting surface of the foundation must be flat, flatness of the supporting surfaces for conventional motors:

Frame size (FS)	Flatness（mm）
≤ 132	0.10
160	0.15
≥ 180	0.20

3.1.2 Installation requirement

Because of the manufacture tolerance and cumulate errors existing in mechanical parts, clearance may exist between the motor feet plane and the foundation support surface.

When install motors, the clearance size must be measured carefully by feeler gauge. For clearance which >0.05mm, shim with proper thickness should be inserted. The size of shim is according to the actual value of clearance.

Insert a shim with proper thickness

3.1.3 Lifting eyes are screwed in place and must be tightened

If the motor is installed vertically with the DE shaft facing downwards, a protective canopy is recommended to cover the fan cowling. This canopy is necessary to prevent the ingress of water and foreign objects that may inhibit proper fan operation.

3.1.4

If the DE shaft is facing upwards, a protective canopy and / or suitable protective measures are recommended to be taken to prevent liquids from entering the motor windings via the shaft.

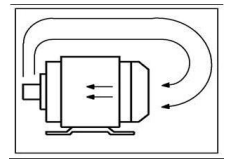
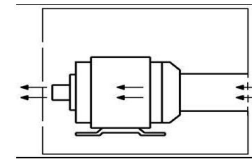
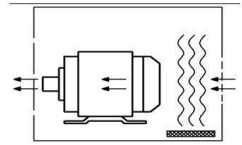
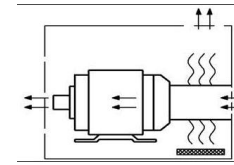
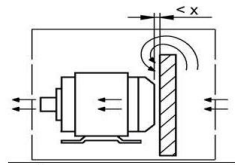
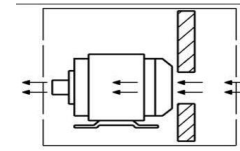
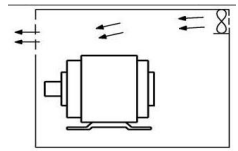
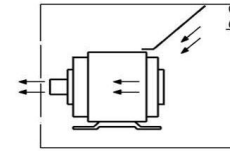
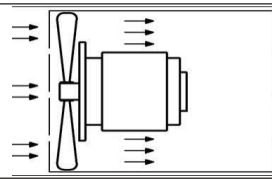
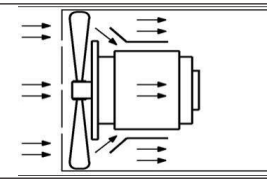
3.1.5 Ensure cooling

! Warning

Death, severe injury or material damage can occur if you do not carefully observe the following points.

- Do not obstruct ventilation.
- Prevent the air expelled by neighboring equipment from being immediately sucked in again.
- For machines with a vertical type construction with air entry from above, prevent the ingress of foreign bodies and water in the air entry openings.
- If the shaft extension is facing upwards, liquid must be prevented from entering by moving along the shaft.

For motors equipped with separately driven fan, please make design to ensure the motor cannot be started when the fan is not running.

Wrong	Correct
	
	
	
	
	

The minimum distance between motor fan cover and adjacent object "X" is shown below:

Frame size	X mm
80 ... 100	20
112	25
132	30
160	40
180 ... 200	90
225 ... 250	100
280 ... 315	110
355	140

3.2 Terminal box

Terminal box is either top or side mounted (LHS or RHS) on the motor and can be rotated 4 times by 90° thus allowing for multiple cable entry possibilities.

3.3 Balancing and coupling of transmission elements

To ensure a quiet and vibration free operation, proper axial and radial alignment of a balanced transmission element (coupling, pulleys, fans, gear box, etc.) is essential.

As standard, the 1LE0 rotors are dynamically balanced using a half feather key as indicated on the ratings name plate (H = Half Key).

Notice

- The transmission and coupling elements are required to be half-key balanced to ensure a vibration free operation.
- Coupling and motor temperature considerations must be taken into account during alignment of the transmission.
- Key must be removed from the motor shaft prior to starting if no transmission is coupled.

3.4 Electrical connection

! Warning

All work must be carried out by skilled worker. Before starting any work, be sure to isolate the machine from the main and auxiliary power supply as applicable. Mains must be secured against accidental switch on.

There are six power terminals and one earthing terminal located in the terminal box. For FS315 and FS355, there is an additional earthing point located on the base of the frame. All motors are suitable for bi - directional rotation (CW or CCW). Phase change can be achieved by interchanging any two phases.

Mains Power Connection

Windings of standard three-phase single speed motors can be connected either in star or delta connection. Voltage and frequency deviations of ± 5%

VAC and ± 2% Hz respectively of the rated voltage and frequency values are acceptable for proper operation.

Cable Connection Examples	External Earthing	

Please refer to Table 1 for tightening torque and direction for electrical terminal lugs.

Please refer to Table 2 for external earthing bolt size and terminal box earthing bolt size.

Table 1

	Size	M4	M5	M6	M8	M10	M12	M16
	Torque（Nm）	1.2	2.5	4.0	8.0	13	20	40

Note: Tightening Torque (Nm, Tolerance: ± 10%)

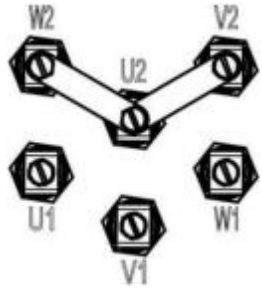
Table 2

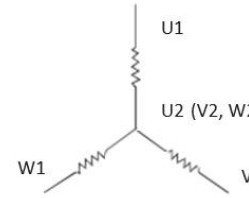
Frame size	80-180	200	225-315	355
External earthing bolt size	M6	M6	M8	M8
Terminal box bolt size	M5	M6	M6	M10

Note:1LE0303/1LE0304-160 Terminal box bolt size M6

Star connection

A star connection is obtained by connecting W2, U2, V2 terminals to each other and the U1, V1, W1 terminals to the mains.

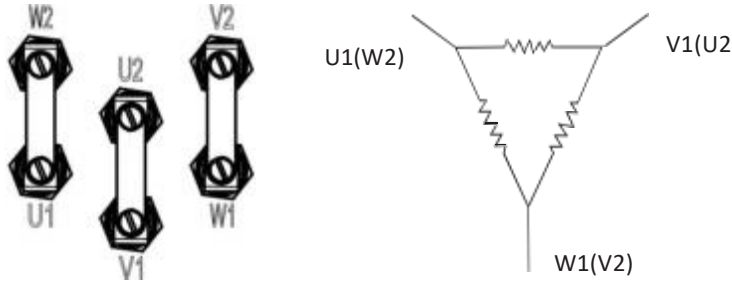




Actual connection method please refer to motor nameplate

Delta connection

A delta connection is obtained by connecting the end of a phase to the beginning of the next phase.



Actual connection method please refer to motor nameplate

Note: If the auxiliary or mains cable entries on the terminal box is sealed with gland plugs, a flat (standard) screw driver is required for removal.

Winding Protection (15th letter of motor code)

1LE0 motors have following types of electrical protection available as an option:

- PTC、PT100 & PT1000 - used for monitoring temperature of stator windings, advise temperature alarming 145 °C or tripping function 155 °C.
- PT100 - used for monitoring temperature of bearing, advise temperature alarming 95 °C or tripping function 105 °C.

Notice

The PTC, PT100 and PT1000 require connection to an external control unit.

When PT100s are used for bearing temperature monitoring, the alarming and tripping values are independent of those of the winding's.

Auxillary terminal Connection

If the motors are configured with winding protection PTC, PT100, PT1000 and space heating, the auxiliary terminal connection is shown in Table 2.

Table 2

One set of PTC	15th digit is B	2TP1
		2TP2
Two set of PTC	15th digit is C	1TP1
		1TP2
		2TP1
		2TP2

One PT1000 sensor	15th digit is K	1R1
		1R2
Two bi-wire PT100	Q72	10R1
		10R2
		11R1
		11R2
Three bi-wire PT100	15th digit is H	1R1
		1R2
		2R1
		2R2
		3R1
		3R2
Heater	Q04	1HE1
		1HE2
Six bi-wire PT100	15th digit is J	1R1
		1R2
		2R1
		2R2
		3R1
		3R2
		4R1
		4R2
		5R1
		5R2
		6R1
		6R2
Three tri-wire PT100	15th digit is Q	1R1
		1R1
		1R2
		2R1
		2R1
		2R2
		3R1
		3R1
		3R2

Six tri-wire PT100	15th digit is R	1R1
		1R1
		1R2
		2R1
		2R1
		2R2
		3R1
		3R1
		3R2
		4R1
		4R1
		4R2
		5R1
		5R1
		5R2
		6R1
		6R1
		6R2

Note: by usage of 2 PTC, terminal 2TP1 and 2TP2 are used for tripping, 1TP1 and 1TP2 are used for alarming.

Motors operating in a wide temperature fluctuation environment are susceptible to condensation water. It is strongly recommended to use an optional heater (option code: Q04).

! Warning

The space heater must never be energized during motor operation.

3.5 Insulation resistance inspection

After extended periods of storage or standstill (6 months or longer), it is recommended to measure the insulation resistance between phases and phase to ground prior to applying power at start-up.

! Warning

During and shortly after the resistance measurement, the motor terminals are hazardous with a residual voltage charge. Avoid touching the terminals.

Insulation resistance

The minimum insulation resistance between new, cleaned or repaired

windings with reference to ground is 10 M Ω .

The critical insulation resistance (Recruit) is calculated by multiplying the rated voltage, e.g. 0.69 kV AC, with the constant factor (0.5M Ω / kV):

Recruit = 0.69 kV × 0.5 M Ω /kV = 0.345 M Ω .

Measurement

The minimum insulation resistance between the windings and ground measurement is taken at 500 V DC and at a winding temperature of 25 °C ± 15 °C.

The measurement of the critical insulation resistance: it should be measured with 500 V DC with the winding at operating temperature.

Normal failure and corrective measures on insulation resistance.

Cause: Might be due to high humidity.

Correction: Windings must be dried.

Cause: After extended periods of operation, the minimum insulation resistance may decrease. However as long as the measured value is not less than the Recruit values the motor will continue to operate.

Correction: If the measured value is less than the Recruit value then the motor must be replaced or repaired.

3.6 Temperature measurement

Temperature is an important reference index of motor running, the important parts for motor realtime temperature, the operation state, effective prevention of master motor fault, to ensure reliable operation is very important.

The motor temperature is influenced by cooling medium and environmental temperature. Measurement of motor winding temperature rise, usually embedded temperature measuring device (such as PT100), temperature measuring element through the lead wire connection control system, the motor temperature, or using the high precision of resistance method is founded. For measuring surface temperature of motor, should use special instruments such as infrared thermometer to measure, measure position generally in the middle position of the motor or eyebolt position.

3.7 Drive Application

⚠ **Warning**

In applications when motor torque is variable (piston-type compressor, load for example), the inevitable result is a non-sinusoidal motor current, whose harmonics can lead to excessive system perturbation or excessive electromagnetic interference.

Electromagnetic compatibility

In application where the motor is driven by a drive, the degree of electrical interference depends on the type of used drive (type, number of IGBTs, interference suppression measures, and manufacturer), cabling, distance and application requirements.

The installation guidelines of the drive manufacturer with regards to electromagnetic compatibility must be considered at all times during the design and implementation phases.

⚠ **Warning**

If the motor is driven by a drive and the, operating speed exceeds synchronous speed then considerations must be given to the mechanical components and transmission coupling.

Please refer to IEC 60034-1 for further details.

Noise, Temperature and Vibration

When motor are used with converter fed operation, the noise and temperature rise will be a little worse than standard motor with rated speed.

Due to increased speeds above the rated speed, vibration of motor will increase. Therefore the mechanical smooth running is changed, and lifetime of grease and bearing will be reduced.

MAINTENAINCE

4

! Warning

Before starting any service and maintenance work on the motor the motor must be properly isolated from the mains and auxiliary power.

The usual "5 safety rules" (as set forth in DIN VDE 0105) are:

- Isolate the equipment
- Take effective measures to prevent reconnection
- Verify equipment is dead
- Ensure Earthing correctly
- Cover or fence off adjacent live parts

These precautions listed above should remain in force until all maintenance work is finished and the motor has been fully assembled.

4.1 Bearing lifetime

The average bearing lifetime for motors with sealed or open bearing at the DE & NDE varies between 20.000 and 40.000 hours for horizontal mounted motors without additional axial loading.

This 20.000 or 40.000 hours of operation applies to 2, 4, 6,8 pole motors when operated at an ambient 40°C based on rating plate data.

Notice

- Every 10K temperature above 40 °C will reduce grease lifetime by half.
- Extended storage periods, excessive vibrations and high humidity levels will reduce the useful life of the DE & NDE bearing and bearing grease.
- For sealed or regreasable bearing, it is recommended that permanently lubricated bearings should be replaced after 24 months of storage.
- If the motor is equipped with regreasable DE& NDE bearing, the grease must be replaced as per the published time intervals in section 4.2.

! Warning

Operating a motor above synchronous speeds for extended periods of time will reduce the bearing grease lifetime.

4.2 Grease type

Type of grease: UNIREX N3 (Esso); Conforms to DIN 51825-K3N.

Motors equipped with a regreasing device will have the grease information stamped on the rating plate or a sticker on the fan cowling.

! Note

Different brands and types of grease must not be mixed.

4.3 Grease lifetime and regreasing intervals

During the bearing lifetime, the grease need not to be changed for the motor with frame size "FS80~90".

When the motor with frame size "FS100~250" runs under rated voltage and frequency in normal environment, the grease need not to be changed during the bearing lifetime. When motor runs under very harsh environment, where grease life is significantly shortened, re-greasing device (option code: L23) is recommended to be selected for convenient grease change. Please refer to the re-greasing intervals in Table 3.

The standard motor with frame size "FS280~355" is equipped with re-greasing device. Please refer to re-greasing intervals in Table 3.

Table 3

Number of Poles	Frame Size	Permanent lubrication	Re-greasing	Re-greasing Interval(h)	Re-greasing quantity(g)
2,4,6	80-90	Standard	-/-	-/-	-/-
2,4,6	100-112	Standard	Option (L23)	8000h	10g
2,4,6,8	132-160	Standard	Option (L23)	8000h	15g
2	180-250	Standard	Option (L23)	4000h	20g
4,6,8	180-250	Standard	Option (L23)	8000h	20g
2	280	-/-	Standard	3000h	30g
4,6,8	280	-/-	Standard	5000h	30g
2	315	-/-	Standard	3000h	40g
4,6,8	315	-/-	Standard	5000h	40g
2	355	-/-	Standard	3000h	40g
4,6,8	355	-/-	Standard	4000h	60g

Exception: 1,In applications where the motor is installed vertically or operating with heavy vibration, sudden load changes, frequent reversing operation, etc., the grease should be changed at considerably more frequent intervals than

the operating hours stated above.2,1LE0004-315 2P Re-greasing quantity 30g.4,6,8P Re-greasing Interval 4000h.

4.4 Re-greasing procedure

! Warning

All local safety regulations must be considered when re-greasing the motor in operation or at a standstill.

! Warning

Care must be taken not to over grease the bearings as this can result in increased bearing temperatures.

Dust and old grease must be prevented from entering the motor bearings during the re-greasing cycles.

Notice

The re-greasing nipple should be cleaned of old grease and dust prior to attaching the re-greasing device. For the waste grease should be properly handled to prevent environmental pollution.

Notice

In order to avoid too much grease in bearing, old grease plug must be removed before adding grease. After adding,please let the motor run a while,check to verify no more grease is coming out,then put back the plug.

It is recommended that the DE and NDE bearings should be re-greased while the motor is in operating and at operating temperature.

If it is not possible to re-grease the motor during operation, then it recommended that a partial amount of the grease is injected and then the motor energized and rotated for a few revolutions to allow for grease dispersion. After coming to a complete stop the remaining grease should be added.

If a DE or NDE bearing have experienced overheating, it is recommended that the bearing should be inspected for heat damage and replaced or re-greased as necessary.

Notice

Bearing grease will appear dark in color if overheating was experienced.

4.5 Bearing replacement – assembly and disassembly

As bearings near the end of their useful lifespan, the vibration and noise levels of the motor will increase considerably.

If bearing inner diameter or wear clearance is out of specification as per table 4, the bearing must be replaced.

Table 4

Frame size	80~112	132~160	180~250	280~355
Bearing inner ø (mm)	20~30	35~50	55~80	85~120
Wear clearance (mm)	0.1	0.15	0.2	0.3

Notice

Worn or damaged bearings must be replaced with an equivalent bearing matching the original specifications.

When replacing the bearing, dismantle the necessary parts and use a suitable bearing extraction tool to remove the damaged or worn bearing.

Before installing the new bearing, pre-heat the bearing as per the manufacture instruction prior to pressing it onto the rotor shaft. Shaft sealing rings (V Ring or Oil Seal) must be replaced with new ones after bearing replacement.

! Warning

Any impacts or hits (such as with a hammer etc.) is strictly forbidden as this will damage the bearing and result in premature failure.

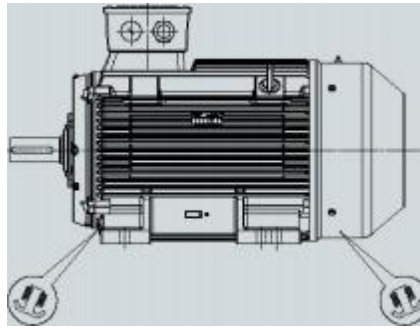
Please refer to tightening torques for the end flange bolts.

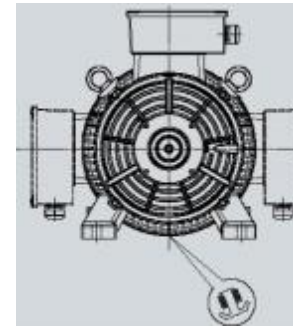
	Size	M4	M5	M6	M8	M10	M12	M16	M20
	Torque（Nm）	2	3.5	6	16	28	46	110	225

Note: Tightening Torque (Nm, Tolerance: ± 10%)

4.6 Condensation drain plug

The condensation drain holes are located on the frame of motor or on the end-shields, depends on construction and mounting type (14th letter of motor code). And the motors with condensation drain holes are delivered from factory with pre-installed plastic plugs. Please refer to the location of condensation drain hole shown in the following pictures.





START UP

5

Preliminary Inspection

Before applying power to the motor for the first time, it is recommended to check:

- All retaining bolts are tightened including transmission coupling and alignment
- Motor cooling fan unobstructed
- Adequate bearing lubrication (grease) if equipped with regreasing nipples
- Mains supply voltage and connection method match those of the rating nameplate for operation on DOL, Soft start, Drive
- Proper connection of earthing (grounding) terminal
- Terminal connection correctness for thermal sensor and space heater if equipped

After power is applied to the motor, be sure to check motor for correct direction of rotation, air flow, current draw and any signs of excessive vibrations and noise levels.

Information according to Article 33 of the REACH regulation

The product contains one or several subproducts in which the following substance – belonging to the "list of candidates" – exists in a concentration exceeding 0.1 percent by weight.

- CAS No. 7439-92-1, lead

Based on the currently available information, we assume that this substance does not represent any risk when correctly used, including its disposal.

Unauthorized modifications, disassembling, or repairing may make warranty invalid.

如有变动，恕不事先通知
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