

机器人技术等级考试 一二级器材套装说明

VEX IQ



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机器人技术等级考试—二级器材套装介绍

本器材套装由创首国际（IFI）提供。创首国际创建于 1996 年，总部位于美国德克萨斯州格林维尔市，是一家研发型高科技企业，创首国际的分公司遍布世界各大洲，包括中国内地的创首科技（武汉）和创首科技（深圳）。公司旗下现有三大著名品牌：

1、VEX 教育机器人是 2016 年唯一入选《机器人商业评论》“RBR50 名单”的教育机器人品牌，是全球最值得关注、最具影响力的 50 强机器人公司之一。VEX 公司拥有三大产品线—VEX IQ、VEX EDR 和 VEXpro，可以提供跨度从小学到大学，甚至是进入职场的所有机器人解决方案。2016-2017 赛季超过 18000 支队伍注册参加 VEX 赛事，其中来自 44 个国家和地区的 1366 支队伍打入 VEX 世界锦标赛，创造了规模最大的机器人比赛世界纪录，2016 年被载入《吉尼斯世界纪录大全》。

2、HEXBUG 赫宝智能玩具为幼儿、儿童青少年、成人和宠物提供益智和娱乐产品。

3、RackSolutions 为全球客户提供数据中心及电脑服务器的机柜机架等产品。

根据机器人等级考试—二级实操试题的大纲要求，该套件搭建制作的模型覆盖了机器人等级考试—二级实操题的全部知识点，可根据每次考试的具体主题搭建相应的模型。

机器人等级考试一级、二级实操题套装均为 VEX 配件，主要包括齿轮、轴、链轮、滑轮、锁片等动力件，及直梁、矩形块、转角接头、销钉等结构件，还有主控器、电机等电子件。

1. 套装参考资料

1.1 套装参考资料内容

- 1) 器材套装说明书
- 2) Modkit 安装软件
- 3) Modkit 案例程序(4 个)
 - ①CIE-10&11 适用于教材第 10 章及第 11 章的程序
 - ②CIE-12&15 适用于教材第 12 章及第 15 章的程序
 - ③CIE-13&14&16-19 适用于第 13、14、16、17、18、19 章的程序
 - ④CIE-20 适用于第 20 章的程序
- 4) 器材套装零件图

1.2 套装参考资料下载网址

- 1) 下载网址：<http://vex-academy.bm.np5-dev.innovationfirst.net>

1.3 安装 Modkit 软件

2. 电子件安装说明

2.1 主控器电池充电

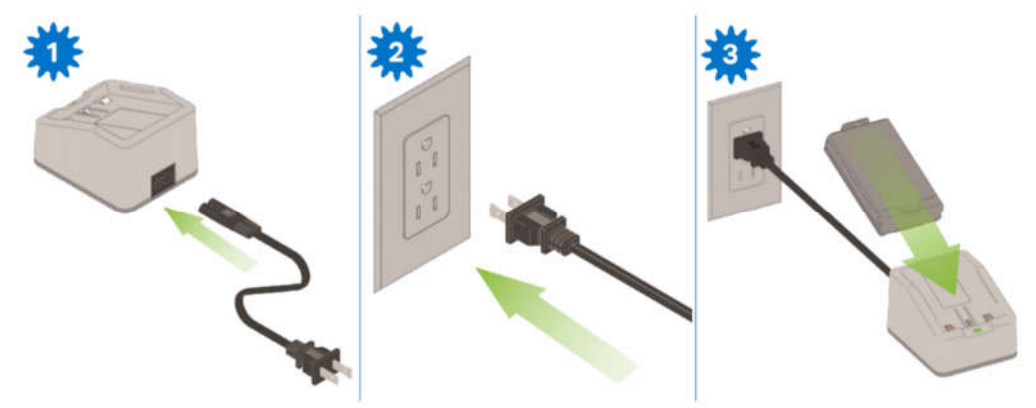


图 1 主控器电池充电步骤

2.2 装卸电池

- 1) 如图 2 所示，安装电池

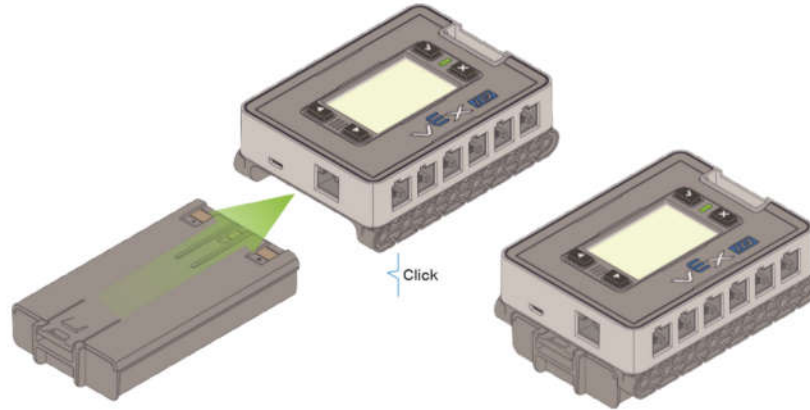


图 2 安装电池

2) 如图 3 所示, 卸载电池

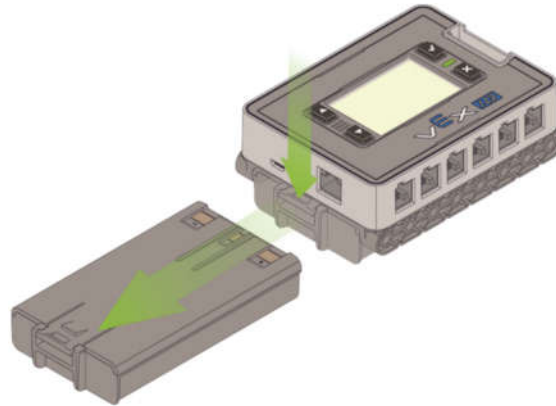


图 3 卸载电池

2.3 硬件连接

- 1) 教材第 10~19 章的模型案例均用到一个电机, 电机与主控器上“1 号端口”连接。
- 2) 教材第 20 章的模型案例用到了两个电机, 分别连接主控器上“1 号端口”和“6 号端口”。
- 3) 连接方式如下图 4 和图 5。

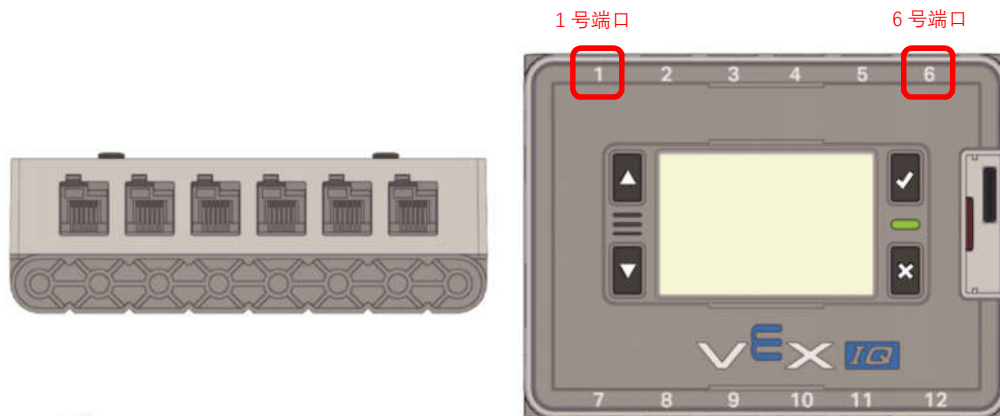


图 4 VEX IQ 主控器



图 5 主控器与电机连接

2.4 下载程序

- 1) 将主控器与电脑用 USB 电缆连接，如图 6 所示。

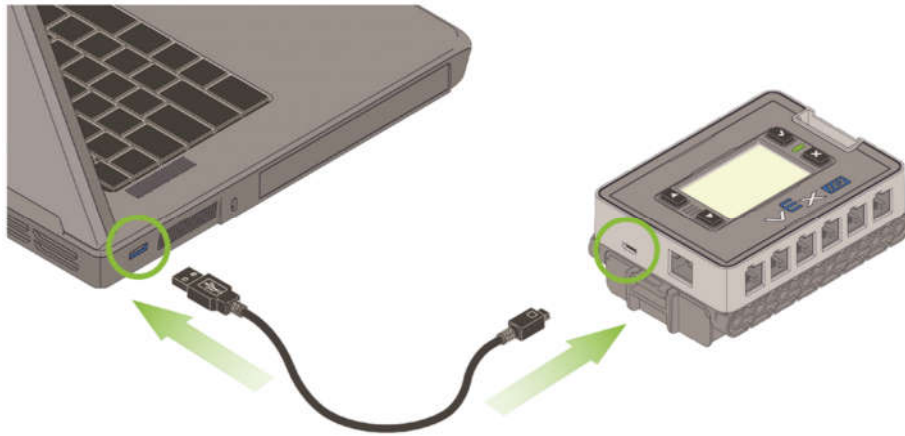


图 6 主控器与电脑连接

- 2) 将主控器开机（主控器已安装电池）：图 6 中主控器为关机状态，按右上“√”按钮，进入如图 7 所示界面。

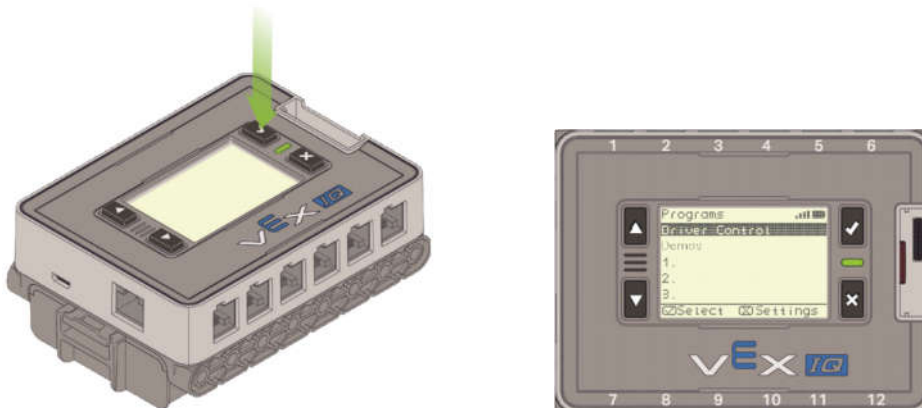


图 7 开机状态的主控器

- 3) 打开程序：在电脑上打开需要下载的程序，进入如图 8 所示 Modkit 界面。（电脑上已安装 Modkit 软件）

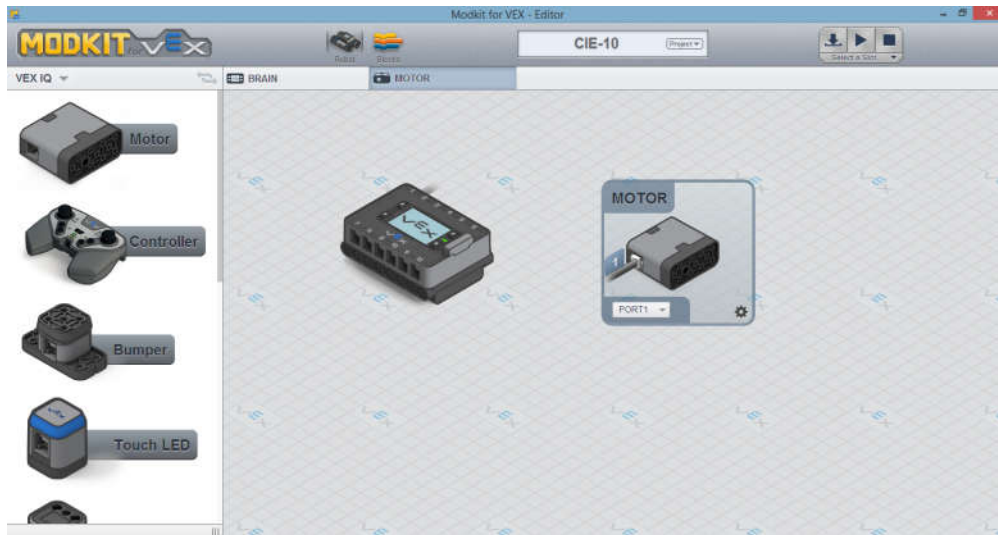


图 8 Modkit 界面

4) 将程序下载到主控器中，如图 9-11。



图 9 点击“Select a Slot”

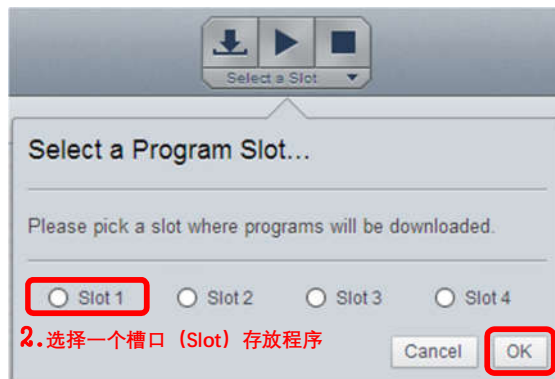


图 10 选择程序存放的位置



图 11 下载程序到主控器

5) 将主控器关机，拔下 USB 电缆。

2.3 VEX IQ 主控器操作

1) 将主控器开机。进入如图 8 所示程序界面，从第三行开始的序号 1、2、3、4 是程序。



图 8 下载程序到主控器

2) 选择程序：按左边两个“上下”按钮，选择需要的程序，按“√”键，进入图 9 界面程序运行。

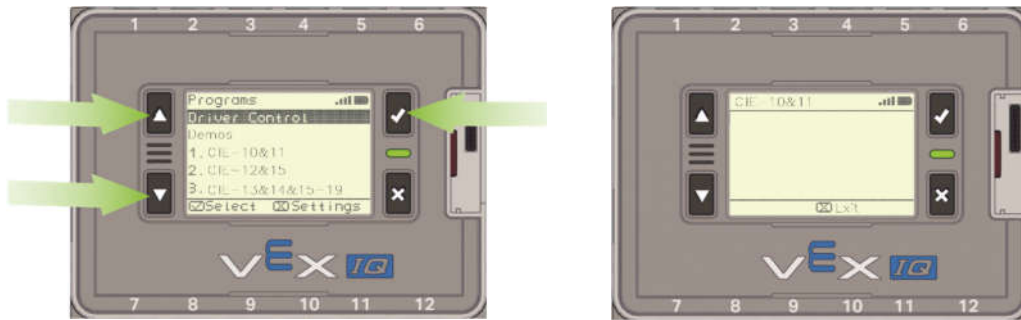


图 9 选择程序

- 3) 退出程序：在程序运行时，如图 9 运行界面所示，再按“x”键，退回到图 8 程序界面。

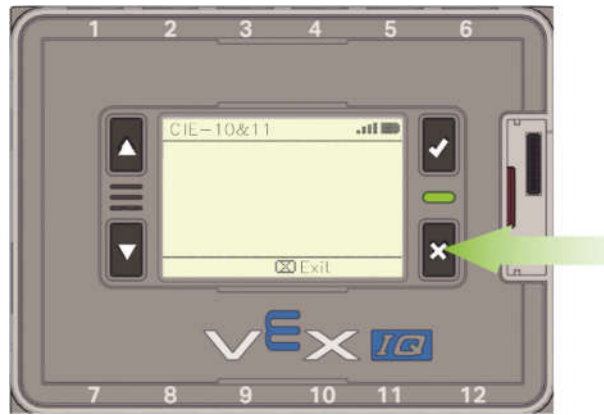


图 10 退出程序

- 4) 关机：长按“x”。

3.附件

3.1 机器人技术等级考试一二级标准器材汇总表

机器人技术等级考试一二级标准器材汇总表

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-002	1x3 Beam (1×3直梁)	4
2	228-3616-004	1x5 Beam (1×5直梁)	2
3	228-3616-005	1x6 Beam (1×6直梁)	4
4	228-3616-006	1x7 Beam (1×7直梁)	4
5	228-3616-007	1x8 Beam (1×8直梁)	3
6	228-3616-008	1x9 Beam (1×9直梁)	6
7	228-3616-009	1x10 Beam (1×10直梁)	2
8	228-3616-010	1x11 Beam (1×11直梁)	2
9	228-3616-011	1x12 Beam (1×12直梁)	2
10	228-3616-012	1x13 Beam (1×13直梁)	2
11	228-3616-013	1x14 Beam (1×14直梁)	2
12	228-3616-014	1x16 Beam (1×16直梁)	2
13	228-3616-018	2x3 Beam (2×3直梁)	2
14	228-3616-021	2x6 Beam (2×6直梁)	3
15	228-3616-023	2x8 Beam (2×8直梁)	4
16	228-3616-025	2x10 Beam (2×10直梁)	2
17	228-3616-026	2x12 Beam (2×12直梁)	4
18	228-3616-028	2x16 Beam (2×16直梁)	2
19	228-3616-034	3x6 Plate (3×6矩形块)	1
20	228-3616-042	4x6 Plate (4×6 矩形块)	2
21	228-3616-043	4x8 Plate (4×8 矩形块)	2
22	228-3616-045	4x12 Plate (4×12 矩形块)	2
23	228-3616-051	6x12 Plate (6×12 矩形块)	1
24	228-3616-059	12x12 Plate (12×12 矩形块)	2
25	228-3196-060	1x1 Connector Pin (1×1 销钉)	80
26	228-3445-061	1x2 Connector Pin (1×2 销钉)	10
27	228-3449-062	2x2 Connector Pin (2×2 销钉)	8
28	228-3943-064	0.5x Pitch Standoff (0.5× 撑柱)	8
29	228-3943-065	1x Pitch Standoff (1× 撑柱)	2
30	228-3201-066	1.5x Pitch Standoff (1.5× 撑柱)	4
31	228-3201-067	2x Pitch Standoff (2× 撑柱)	10
32	228-3201-070	4x Pitch Standoff (4× 撑柱)	6
33	228-3201-072	6x Pitch Standoff (6× 撑柱)	4
34	228-3450-078	2x Pitch Plastic Motor Shaft (2× 电机轴)	2
35	228-3450-079	4x Pitch Plastic Motor Shaft (4× 电机轴)	2
36	228-3448-080	2x Pitch Capped Plastic Shaft (2× 钉轴)	2
37	228-3448-081	3x Pitch Capped Plastic Shaft (3× 钉轴)	2
38	228-3448-082	4x Pitch Capped Plastic Shaft (4× 钉轴)	3
39	228-3448-083	5x Pitch Capped Plastic Shaft (5× 钉轴)	3
40	228-3451-084	0x2 Idler Pin (0×2 惰轮销钉)	5
41	228-3943-098	1x2 Idler Pin (1×2 惰轮销钉)	4
42	228-3445-114	0.25x Spacer (垫圈)	25
43	228-2500-120	4x Shaft (4× 钢轴)	2
44	228-2500-122	6x Shaft (6× 钢轴)	3
45	228-2500-124	8x Shaft (8× 钢轴)	3
46	228-3616-125	Shaft Bushing (轴衬)	3
47	228-3201-126	Large Chassis Corner Connector (大号底盘转角接头)	12
48	228-3201-127	Small Chassis Corner Connector (小号底盘转角接头)	8
49	228-3449-128	2x Wide, 1x2 Corner Connector (2×宽, 1×2转角接头)	8

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
50	228-3446-130	1x Wide, 1x1 Offset Corner Connector (1×宽, 1×1位移转角接头)	8
51	228-3450-131	2x Wide, 2x1 Offset Corner Connector (2×宽, 2×1位移转角接头)	2
52	228-3448-133	2x Wide, 1x1 Offset Corner Connector (2×宽, 1×1位移转角接头)	4
53	228-3201-134	2x Wide, 2x2 Corner Connector (2×宽, 2×2转角接头)	10
54	228-3451-135	2x Wide, 1x2 Offset Corner Connector (2×宽, 1×2位移转角接头)	9
55	228-3450-140	2x2 Shaft Lock Plate (2×2锁片)	2
56	228-3450-141	1x3 Shaft Lock Plate (1×3锁片)	3
57	228-3201-143	Rubber Shaft Collar (轴箍)	20
58	228-3616-145	2x3 Right Angle Beam (2×3 直角弯梁)	5
59	228-3446-147	3x3 30 Degree Angle Beam (30° 弯梁)	5
60	228-3196-149	3x3 60 Degree Angle Beam (60° 弯梁)	3
61	228-3616-151	4x4 Offset Right Angle Beam (4×4位移直角弯梁)	3
62	228-3201-161	3x3 Wye Lock Beam (3×3 锁片)	2
63	228-3196-164	20mm Pulley (20mm 滑轮)	3
64	228-3196-165	30mm Pulley (30mm 滑轮)	3
65	228-3196-166	40mm Pulley (40mm 滑轮)	2
66	228-3616-170	Mini Standoff Connector (Mini 撑柱接头)	10
67	228-3616-171	Straight Standoff Connector (直撑柱接头)	3
68	228-3616-172	End Standoff Connector (末端 撑柱接头)	2
69	228-3449-208	Small Wheel Hub (轮毂)	4
70	228-3201-209	200mm Travel Rubber Tire (200mm轮胎)	4
71	228-3196-213	12 Tooth Gear (12t 齿轮)	5
72	228-3196-214	36 Tooth Gear (36t 齿轮)	5
73	228-3196-215	60 Tooth Gear (60t 齿轮)	3
74	228-3196-218	36 Tooth Crown Gear (36t 冠状齿轮)	2
75	228-3201-223	50mm Diameter Rubber Belt (50mm 皮带)	2
76	228-3445-227	24 Tooth Gear (24t 齿轮)	2
77	228-3616-230	Chain Link (链条)	200
78	228-3616-231	Tank Tread Attachment Link (履带)	200
79	228-3446-232	8 Tooth Sprocket (8t 链轮)	5
80	228-3446-233	16 Tooth Sprocket (16t 链轮)	2
81	228-3446-235	24 Tooth Sprocket (24t 链轮)	4
82	228-3446-236	32 Tooth Sprocket (32t 链轮)	1
83	228-3451-237	40 Tooth Sprocket (40t 链轮)	1
84	228-3616-246	1x4 Crank Arm with 23 Tooth Gear (悬臂齿轮)	2
85	228-2500-262	11x Shaft (11t 钢轴)	3
86	228-2500-263	12x Shaft (12t 钢轴)	2
87	228-2500-264	14x Shaft (14t 钢轴)	2
88	228-2500-272	Double 1x Wide, 2×1 Corner Connector (双头1×宽, 2×1转角接头)	3
89	228-3196-420	1x Wide Spool (线轴)	1
90	228-3448-451	36 Tooth Dog Gear (36t 惰齿轮)	2
91	275-1089	Rubber Band(橡皮筋)	1
92	228-2500-156	3×3十字	1
93	228-2500-159	Single Motor Support Cap (单个电机支撑盖)	1
94	228-1252	三头转角接头	3
95		线	1
96	228-2560	Smart Motor (智能电机)	2
97	228-2540	Robot Brain (主控制器)	1
98	228-2604	Robot Battery (主控制器电池)	1

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
99	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
100	228-2743	Robot Battery Charger (主控器电池充电器)	1
101	276-2520	Battery Charger Power Cord (充电器电缆)	1
102	228-2785	USB Cable (USB电缆)	1
103	228-3036	Storage Bin and Tray (储物箱和零件分类盘)	1

表 1 机器人技术等级考试一二级标准器材汇总表

3.2 教材第 2~20 章案例零件清单表

教材第二章案例——秋千

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-007	1x8 Beam (1×8直梁)	2
2	228-3616-010	1x11 Beam (1×11直梁)	2
3	228-3616-014	1x16 Beam (1×16直梁)	2
4	228-3616-026	2x12 Beam (2×12直梁)	2
5	228-3616-042	4x6 Plate (4×6 矩形块)	1
6	228-3616-043	4x8 Plate (4×8 矩形块)	1
7	228-3196-060	1x1 Connector Pin (1×1 销钉)	10
8	228-3201-127	Small Chassis Corner Connector (小号底盘转角接头)	4
9	228-3450-131	2x Wide, 2x1 Offset Corner Connector (2×宽, 2×1位移转角接头)	2
10	228-3201-143	Rubber Shaft Collar (轴箍)	4
11	228-2500-262	11x Shaft (11t 钢轴)	1

表 2 秋千零件清单

教材第三章案例——跷跷板

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-014	1x16 Beam (1×16直梁)	2
2	228-3616-042	4x6 Plate (4×6 矩形块)	1
3	228-3449-062	2x2 Connector Pin (2×2 销钉)	4
4	228-2500-122	6x Shaft (6× 钢轴)	1
5	228-3450-131	2x Wide, 2x1 Offset Corner Connector (2×宽, 2×1位移转角接头)	2
6	228-3201-143	Rubber Shaft Collar (轴箍)	2
7	228-3616-145	2x3 Right Angle Beam (2×3 直角弯梁)	4
8	228-3616-170	Mini Standoff Connector (Mini 撑柱接头)	2

表 3 跷跷板零件清单

教材第四章案例——搅拌机

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-005	1x6 Beam (1×6直梁)	3
2	228-3616-013	1x14 Beam (1×14直梁)	2
3	228-3201-067	2x Pitch Standoff (2× 撑柱)	4
4	228-3201-072	6x Pitch Standoff (6× 撑柱)	1
5	228-3445-114	0.25x Spacer (垫圈)	1
6	228-3201-126	Large Chassis Corner Connector (大号底盘转角接头)	3
7	228-3201-127	Small Chassis Corner Connector (小号底盘转角接头)	3
8	228-3201-143	Rubber Shaft Collar (轴箍)	12
9	228-3201-161	3x3 Wye Lock Beam (3×3 锁片)	1
10	228-3196-166	40mm Pulley (40mm 滑轮)	1
11	228-3196-213	12 Tooth Gear (12t 齿轮)	2
12	228-3196-214	36 Tooth Gear (36t 齿轮)	1
13	228-3196-218	36 Tooth Crown Gear (36t 冠状齿轮)	1
14	228-2500-262	11x Shaft (11t 钢轴)	2
15	228-2500-263	12x Shaft (12t 钢轴)	1

表 4 搅拌机零件清单

教材第五章案例——奇怪的时钟

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-006	1x7 Beam (1×7直梁)	1
2	228-3616-011	1x12 Beam (1×12直梁)	2
3	228-3616-026	2x12 Beam (2×12直梁)	2
4	228-3616-043	4x8 Plate (4×8 矩形块)	1
5	228-3196-060	1x1 Connector Pin (1×1 销钉)	14
6	228-3201-072	6x Pitch Standoff (6× 撑柱)	1
7	228-3445-114	0.25x Spacer (垫圈)	5
8	228-3450-131	2x Wide, 2x1 Offset Corner Connector (2×宽, 2×1位移转角接头)	2
9	228-3201-143	Rubber Shaft Collar (轴箍)	7
10	228-3201-161	3x3 Wye Lock Beam (3×3 锁片)	1
11	228-3196-213	12 Tooth Gear (12t 齿轮)	1
12	228-3196-214	36 Tooth Gear (36t 齿轮)	1
13	228-3196-215	60 Tooth Gear (60t 齿轮)	1
14	228-3616-246	1x4 Crank Arm with 23 Tooth Gear (悬臂齿轮)	1
15	228-2500-262	11x Shaft (11t 钢轴)	2
16	228-3448-451	36 Tooth Dog Gear (36t 惰齿轮)	1

表 5 奇怪的时钟零件清单

教材第六章案例——起重机

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-004	1x5 Beam (1×5直梁)	1
2	228-3616-009	1x10 Beam (1×10直梁)	2
3	228-3616-014	1x16 Beam (1×16直梁)	2
4	228-3616-026	2x12 Beam (2×12直梁)	2
5	228-3616-043	4x8 Plate (4×8 矩形块)	1
6	228-3196-060	1x1 Connector Pin (1×1 销钉)	11
7	228-3201-067	2x Pitch Standoff (2× 撑柱)	1
8	228-3201-070	4x Pitch Standoff (4× 撑柱)	1
9	228-3448-081	3x Pitch Capped Plastic Shaft (3× 钉轴)	1
10	228-2500-124	8x Shaft (8× 钢轴)	1
11	228-3201-127	Small Chassis Corner Connector (小号底盘转角接头)	6
12	228-3446-130	1x Wide, 1x1 Offset Corner Connector (1×宽, 1×1位移转角接头)	2
13	228-3450-131	2x Wide, 2x1 Offset Corner Connector (2×宽, 2×1位移转角接头)	2
14	228-3201-143	Rubber Shaft Collar (轴箍)	5
15	228-3616-145	2x3 Right Angle Beam (2×3 直角弯梁)	1
16	228-3196-164	20mm Pulley (20mm 滑轮)	1
17	228-3196-165	30mm Pulley (30mm 滑轮)	1
18	228-3616-170	Mini Standoff Connector (Mini 撑柱接头)	1
19	228-3196-420	1x Wide Spool (线轴)	1
20		线	1

表 6 起重机零件清单

教材第七章案例——烤肉架

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-026	2x12 Beam (2×12直梁)	2
2	228-3616-043	4x8 Plate (4×8 矩形块)	1
3	228-3201-067	2x Pitch Standoff (2× 撑柱)	1
4	228-3201-070	4x Pitch Standoff (4× 撑柱)	2
5	228-3445-114	0.25x Spacer (垫圈)	4
6	228-2500-124	8x Shaft (8× 钢轴)	2
7	228-3201-126	Large Chassis Corner Connector (大号底盘转角接头)	4
8	228-3201-143	Rubber Shaft Collar (轴箍)	10
9	228-3196-165	30mm Pulley (30mm 滑轮)	1
10	228-3196-213	12 Tooth Gear (12t 齿轮)	2
11	228-3196-214	36 Tooth Gear (36t 齿轮)	2
12	228-2500-262	11x Shaft (11t 钢轴)	2

表 7 烤肉架零件清单

教材第八章案例——手动风扇

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-004	1x5 Beam (1×5直梁)	2
2	228-3616-010	1x11 Beam (1×11直梁)	1
3	228-3616-011	1x12 Beam (1×12直梁)	2
4	228-3616-042	4x6 Plate (4×6 矩形块)	2
5	228-3616-051	6x12 Plate (6×12 矩形块)	1
6	228-3196-060	1x1 Connector Pin (1×1 销钉)	12
7	228-3445-114	0.25x Spacer (垫圈)	4
8	228-2500-124	8x Shaft (8× 钢轴)	1
9	228-3201-126	Large Chassis Corner Connector (大号底盘转角接头)	4
10	228-3201-143	Rubber Shaft Collar (轴箍)	10
11	228-3201-161	3x3 Wye Lock Beam (3×3 锁片)	1
12	228-3196-213	12 Tooth Gear (12t 齿轮)	2
13	228-3196-215	60 Tooth Gear (60t 齿轮)	2
14	228-3451-237	40 Tooth Sprocket (40t 链轮)	1
15	228-2500-262	11x Shaft (11t 钢轴)	2

表 8 手动风扇零件清单

教材第九章案例——履带车

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-005	1x6 Beam (1×6直梁)	1
2	228-3616-009	1x10 Beam (1×10直梁)	2
3	228-3196-060	1x1 Connector Pin (1×1 销钉)	4
4	228-3201-072	6x Pitch Standoff (6× 撑柱)	1
5	228-3201-126	Large Chassis Corner Connector (大号底盘转角接头)	2
6	228-3201-143	Rubber Shaft Collar (轴箍)	6
7	228-3616-145	2x3 Right Angle Beam (2×3 直角弯梁)	2
8	228-3616-170	Mini Standoff Connector (Mini 撑柱接头)	4
9	228-3616-231	Tank Tread Attachment Link (履带)	200
10	228-3446-232	8 Tooth Sprocket (8t 链轮)	4
11	228-3446-235	24 Tooth Sprocket (24t 链轮)	2
12	228-2500-262	11x Shaft (11t 钢轴)	3

表 9 履带车零件清单

教材第十章案例——直升机

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-006	1x7 Beam (1×7直梁)	3
2	228-3616-007	1x8 Beam (1×8直梁)	2
3	228-3616-008	1x9 Beam (1×9直梁)	2
4	228-3616-009	1x10 Beam (1×10直梁)	2
5	228-3616-018	2x3 Beam (2×3直梁)	2
6	228-3616-023	2x8 Beam (2×8直梁)	1
7	228-3616-043	4x8 Plate (4×8 矩形块)	1
8	228-3196-060	1x1 Connector Pin (1×1 销钉)	16
9	228-3445-061	1x2 Connector Pin (1×2 销钉)	2
10	228-3943-064	0.5x Pitch Standoff (0.5× 撑柱)	4
11	228-3201-067	2x Pitch Standoff (2× 撑柱)	8
12	228-3450-078	2x Pitch Plastic Motor Shaft (2× 电机轴)	1
13	228-3448-082	4x Pitch Capped Plastic Shaft (4× 钉轴)	1
14	228-3445-114	0.25x Spacer (垫圈)	8
15	228-3201-126	Large Chassis Corner Connector (大号底盘转角接头)	2
16	228-3449-128	2x Wide, 1x2 Corner Connector (2×宽, 1×2转角接头)	2
17	228-3201-134	2x Wide, 2x2 Corner Connector (2×宽, 2×2转角接头)	1
18	228-3201-143	Rubber Shaft Collar (轴箍)	5
19	228-3201-161	3x3 Wye Lock Beam (3×3 锁片)	1
20	228-3616-170	Mini Standoff Connector (Mini 撑柱接头)	2
21	228-3196-214	36 Tooth Gear (36t 齿轮)	1
22	228-3196-218	36 Tooth Crown Gear (36t 冠状齿轮)	1
23	228-3445-227	24 Tooth Gear (24t 齿轮)	1
24	228-2500-263	12x Shaft (12t 钢轴)	1
25	228-2500-156	3×3十字	1
26	228-2560	Smart Motor (智能电机)	1
27	228-2540	Robot Brain (主控器)	1
28	228-2604	Robot Battery (主控器电池)	1
29	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
30	228-2743	Robot Battery Charger (主控器电池充电器)	1
31	276-2520	Battery Charger Power Cord (充电器电缆)	1
32	228-2785	USB Cable (USB电缆)	1

表 10 直升机零件清单

教材第十一章案例——后轮驱动车

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-005	1x6 Beam (1×6直梁)	4
2	228-3616-023	2x8 Beam (2×8直梁)	2
3	228-3616-028	2x16 Beam (2×16直梁)	2
4	228-3616-043	4x8 Plate (4×8 矩形块)	1
5	228-3196-060	1x1 Connector Pin (1×1 销钉)	12
6	228-3450-078	2x Pitch Plastic Motor Shaft (2× 电机轴)	1
7	228-3445-114	0.25x Spacer (垫圈)	8
8	228-2500-124	8x Shaft (8× 钢轴)	1
9	228-3201-127	Small Chassis Corner Connector (小号底盘转角接头)	4
10	228-3449-128	2x Wide, 1x2 Corner Connector (2×宽, 1×2转角接头)	4
11	228-3201-143	Rubber Shaft Collar (轴箍)	11
12	228-3449-208	Small Wheel Hub (轮毂)	4
13	228-3201-209	200mm Travel Rubber Tire (200mm轮胎)	4
14	228-3196-213	12 Tooth Gear (12t 齿轮)	1
15	228-3196-214	36 Tooth Gear (36t 齿轮)	2
16	228-3196-218	36 Tooth Crown Gear (36t 冠状齿轮)	1
17	228-2500-263	12x Shaft (12t 钢轴)	2
18	228-2560	Smart Motor (智能电机)	1
19	228-2540	Robot Brain (主控器)	1
20	228-2604	Robot Battery (主控器电池)	1
21	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
22	228-2743	Robot Battery Charger (主控器电池充电器)	1
23	276-2520	Battery Charger Power Cord (充电器电缆)	1
24	228-2785	USB Cable (USB电缆)	1

表 11 后轮驱动车零件清单

教材第十二章案例——机械尺蠖

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-002	1x3 Beam (1×3直梁)	1
2	228-3616-005	1x6 Beam (1×6直梁)	1
3	228-3616-026	2x12 Beam (2×12直梁)	4
4	228-3196-060	1x1 Connector Pin (1×1 销钉)	10
5	228-3943-064	0.5x Pitch Standoff (0.5× 撑柱)	3
6	228-3943-065	1x Pitch Standoff (1× 撑柱)	1
7	228-3201-067	2x Pitch Standoff (2× 撑柱)	6
8	228-3450-079	4x Pitch Plastic Motor Shaft (4× 电机轴)	1
9	228-3445-114	0.25x Spacer (垫圈)	4
10	228-2500-122	6x Shaft (6× 钢轴)	2
11	228-3446-130	1x Wide, 1x1 Offset Corner Connector (1×宽, 1×1位移转角接头)	2
12	228-3201-143	Rubber Shaft Collar (轴箍)	11
13	228-3616-170	Mini Standoff Connector (Mini 撑柱接头)	4
14	228-3616-171	Straight Standoff Connector (直撑柱接头)	2
15	228-3449-208	Small Wheel Hub (轮毂)	4
16	228-3201-209	200mm Travel Rubber Tire (200mm轮胎)	4
17	228-3196-214	36 Tooth Gear (36t 齿轮)	1
18	228-3446-235	24 Tooth Sprocket (24t 链轮)	2
19	275-1089	Rubber Band(橡皮筋)	1
20	228-2560	Smart Motor (智能电机)	1
21	228-2540	Robot Brain (主控器)	1
22	228-2604	Robot Battery (主控器电池)	1
23	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
24	228-2743	Robot Battery Charger (主控器电池充电器)	1
25	276-2520	Battery Charger Power Cord (充电器电缆)	1
26	228-2785	USB Cable (USB电缆)	1

表 12 机械尺蠖零件清单

教材第十三章案例——石油开采机

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-008	1x9 Beam (1×9直梁)	1
2	228-3616-009	1x10 Beam (1×10直梁)	1
3	228-3616-010	1x11 Beam (1×11直梁)	1
4	228-3616-021	2x6 Beam (2×6直梁)	3
5	228-3616-059	12x12 Plate (12×12 矩形块)	1
6	228-3196-060	1x1 Connector Pin (1×1 销钉)	18
7	228-3201-067	2x Pitch Standoff (2× 撑柱)	4
8	228-2500-120	4x Shaft (4× 钢轴)	1
9	228-2500-124	8x Shaft (8× 钢轴)	2
10	228-3201-126	Large Chassis Corner Connector (大号底盘转角接头)	3
11	228-3201-134	2x Wide, 2x2 Corner Connector (2×宽, 2×2转角接头)	4
12	228-3201-143	Rubber Shaft Collar (轴箍)	6
13	228-3616-170	Mini Standoff Connector (Mini 撑柱接头)	4
14	228-3616-172	End Standoff Connector (末端 撑柱接头)	1
15	228-3616-230	Chain Link (链条)	200
16	228-3446-232	8 Tooth Sprocket (8t 链轮)	1
17	228-3446-235	24 Tooth Sprocket (24t 链轮)	1
18	228-3616-246	1x4 Crank Arm with 23 Tooth Gear (悬臂齿轮)	1
19	228-2500-262	11x Shaft (11t 钢轴)	1
20	228-2560	Smart Motor (智能电机)	1
21	228-2540	Robot Brain (主控器)	1
22	228-2604	Robot Battery (主控器电池)	1
23	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
24	228-2743	Robot Battery Charger (主控器电池充电器)	1
25	276-2520	Battery Charger Power Cord (充电器电缆)	1
26	228-2785	USB Cable (USB电缆)	1

表 13 石油开采机零件清单

教材第十四章案例——稻草人

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-004	1x5 Beam (1×5直梁)	1
2	228-3616-012	1x13 Beam (1×13直梁)	1
3	228-3616-014	1x16 Beam (1×16直梁)	1
4	228-3616-043	4x8 Plate (4×8 矩形块)	1
5	228-3616-051	6x12 Plate (6×12 矩形块)	1
6	228-3196-060	1x1 Connector Pin (1×1 销钉)	11
7	228-3445-061	1x2 Connector Pin (1×2 销钉)	5
8	228-3450-078	2x Pitch Plastic Motor Shaft (2× 电机轴)	1
9	228-3448-081	3x Pitch Capped Plastic Shaft (3× 钉轴)	1
10	228-3451-084	0x2 Idler Pin (0×2 惰轮销钉)	3
11	228-3201-126	Large Chassis Corner Connector (大号底盘转角连接头)	2
12	228-3201-143	Rubber Shaft Collar (轴箍)	2
13	228-3196-164	20mm Pulley (20mm 滑轮)	1
14	228-3196-166	40mm Pulley (40mm 滑轮)	1
15	228-3196-214	36 Tooth Gear (36t 齿轮)	1
16	228-3201-223	50mm Diameter Rubber Belt (50mm 皮带)	1
17	228-3446-232	8 Tooth Sprocket (8t 链轮)	2
18	228-3446-236	32 Tooth Sprocket (32t 链轮)	1
19	228-2500-156	3×3十字	1
20	228-2560	Smart Motor (智能电机)	1
21	228-2540	Robot Brain (主控器)	1
22	228-2604	Robot Battery (主控器电池)	1
23	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
24	228-2743	Robot Battery Charger (主控器电池充电器)	1
25	276-2520	Battery Charger Power Cord (充电器电缆)	1
26	228-2785	USB Cable (USB电缆)	1

表 14 稻草人零件清单

教材第十五章案例——舂米机

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-002	1x3 Beam (1×3直梁)	4
2	228-3616-012	1x13 Beam (1×13直梁)	2
3	228-3616-018	2x3 Beam (2×3直梁)	1
4	228-3616-023	2x8 Beam (2×8直梁)	4
5	228-3616-026	2x12 Beam (2×12直梁)	3
6	228-3616-059	12x12 Plate (12×12 矩形块)	2
7	228-3196-060	1x1 Connector Pin (1×1 销钉)	10
8	228-3449-062	2x2 Connector Pin (2×2 销钉)	4
9	228-3943-065	1x Pitch Standoff (1× 撑柱)	1
10	228-3201-066	1.5x Pitch Standoff (1.5× 撑柱)	2
11	228-3201-072	6x Pitch Standoff (6× 撑柱)	2
12	228-3445-114	0.25x Spacer (垫圈)	4
13	228-2500-120	4x Shaft (4× 钢轴)	1
14	228-2500-124	8x Shaft (8× 钢轴)	1
15	228-3201-126	Large Chassis Corner Connector (大号底盘转角接头)	9
16	228-3448-133	2x Wide, 1x1 Offset Corner Connector (2×宽, 1×1位移转角接头)	1
17	228-3201-143	Rubber Shaft Collar (轴箍)	7
18	228-3196-164	20mm Pulley (20mm 滑轮)	1
19	228-3196-166	40mm Pulley (40mm 滑轮)	1
20	228-3201-223	50mm Diameter Rubber Belt (50mm 皮带)	1
21	228-3616-246	1x4 Crank Arm with 23 Tooth Gear (悬臂齿轮)	2
22	228-2560	Smart Motor (智能电机)	1
23	228-2540	Robot Brain (主控器)	1
24	228-2604	Robot Battery (主控器电池)	1
25	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
26	228-2743	Robot Battery Charger (主控器电池充电器)	1
27	276-2520	Battery Charger Power Cord (充电器电缆)	1
28	228-2785	USB Cable (USB电缆)	1

表 15 舂米机零件清单

教材第十六章案例——乌龟

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-023	2x8 Beam (2×8直梁)	1
2	228-3616-043	4x8 Plate (4×8 矩形块)	1
3	228-3616-045	4x12 Plate (4×12 矩形块)	2
4	228-3196-060	1x1 Connector Pin (1×1 销钉)	14
5	228-3445-061	1x2 Connector Pin (1×2 销钉)	2
6	228-3449-062	2x2 Connector Pin (2×2 销钉)	2
7	228-3450-078	2x Pitch Plastic Motor Shaft (2× 电机轴)	1
8	228-3445-114	0.25x Spacer (垫圈)	5
9	228-3201-126	Large Chassis Corner Connector (大号底盘转角连接头)	4
10	228-3449-128	2x Wide, 1x2 Corner Connector (2×宽, 1×2转角连接头)	2
11	228-3201-143	Rubber Shaft Collar (轴箍)	5
12	228-3446-147	3x3 30 Degree Angle Beam (30° 弯梁)	4
13	228-3196-149	3x3 60 Degreee Angle Beam (60° 弯梁)	2
14	228-3616-170	Mini Standoff Connector (Mini 撑柱连接头)	2
15	228-3196-214	36 Tooth Gear (36t 齿轮)	4
16	228-3616-230	Chain Link (链条)	200
17	228-3446-232	8 Tooth Sprocket (8t 链轮)	1
18	228-3446-233	16 Tooth Sprocket (16t 链轮)	2
19	228-2500-264	14x Shaft (14t 钢轴)	2
20	228-2560	Smart Motor (智能电机)	1
21	228-2540	Robot Brain (主控器)	1
22	228-2604	Robot Battery (主控器电池)	1
23	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
24	228-2743	Robot Battery Charger (主控器电池充电器)	1
25	276-2520	Battery Charger Power Cord (充电器电缆)	1
26	228-2785	USB Cable (USB电缆)	1

表 16 乌龟零件清单

教材第十七章案例——挖掘机

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-004	1x5 Beam (1×5直梁)	2
2	228-3616-007	1x8 Beam (1×8直梁)	3
3	228-3616-009	1x10 Beam (1×10直梁)	2
4	228-3616-010	1x11 Beam (1×11直梁)	2
5	228-3616-011	1x12 Beam (1×12直梁)	2
6	228-3616-021	2x6 Beam (2×6直梁)	2
7	228-3616-023	2x8 Beam (2×8直梁)	1
8	228-3616-026	2x12 Beam (2×12直梁)	2
9	228-3616-043	4x8 Plate (4×8 矩形块)	1
10	228-3196-060	1x1 Connector Pin (1×1 销钉)	60
11	228-3201-072	6x Pitch Standoff (6× 撑柱)	2
12	228-3448-080	2x Pitch Capped Plastic Shaft (2× 钉轴)	1
13	228-3445-114	0.25x Spacer (垫圈)	4
14	228-3201-126	Large Chassis Corner Connector (大号底盘转角接头)	2
15	228-3449-128	2x Wide, 1x2 Corner Connector (2×宽, 1×2转角接头)	1
16	228-3451-135	2x Wide, 1x2 Offset Corner Connector (2×宽, 1×2位移转角接头)	7
17	228-3201-143	Rubber Shaft Collar (轴箍)	8
18	228-3446-147	3x3 30 Degree Angle Beam (30° 弯梁)	2
19	228-3616-151	4x4 Offset Right Angle Beam (4×4位移直角弯梁)	2
20	228-3196-164	20mm Pulley (20mm 滑轮)	1
21	228-3196-165	30mm Pulley (30mm 滑轮)	1
22	228-3616-170	Mini Standoff Connector (Mini 撑柱接头)	6
23	228-3201-223	50mm Diameter Rubber Belt (50mm 皮带)	1
24	228-3616-231	Tank Tread Attachment Link (履带)	200
25	228-3446-235	24 Tooth Sprocket (24t 链轮)	4
26	228-2500-264	14x Shaft (14t 钢轴)	2
27	228-2500-159	Single Motor Support Cap (单个电机支撑盖)	1
28	228-2560	Smart Motor (智能电机)	1
29	228-2540	Robot Brain (主控器)	1
30	228-2604	Robot Battery (主控器电池)	1
31	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
32	228-2743	Robot Battery Charger (主控器电池充电器)	1
33	276-2520	Battery Charger Power Cord (充电器电缆)	1
34	228-2785	USB Cable (USB电缆)	1

表 17 挖掘机零件清单

教材第十八章案例——旋转杯

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-013	1x14 Beam (1×14直梁)	2
2	228-3616-021	2x6 Beam (2×6直梁)	2
3	228-3616-042	4x6 Plate (4×6 矩形块)	1
4	228-3616-043	4x8 Plate (4×8 矩形块)	2
5	228-3616-045	4x12 Plate (4×12 矩形块)	1
6	228-3616-051	6x12 Plate (6×12 矩形块)	1
7	228-3196-060	1x1 Connector Pin (1×1 销钉)	16
8	228-3943-064	0.5x Pitch Standoff (0.5× 撑柱)	4
9	228-3201-067	2x Pitch Standoff (2× 撑柱)	2
10	228-3201-070	4x Pitch Standoff (4× 撑柱)	4
11	228-3450-078	2x Pitch Plastic Motor Shaft (2× 电机轴)	1
12	228-3448-082	4x Pitch Capped Plastic Shaft (4× 钉轴)	2
13	228-3448-083	5x Pitch Capped Plastic Shaft (5× 钉轴)	2
14	228-3445-114	0.25x Spacer (垫圈)	6
15	228-3616-125	Shaft Bushing (轴衬)	2
16	228-3449-128	2x Wide, 1x2 Corner Connector (2×宽, 1×2转角连接头)	6
17	228-3450-141	1x3 Shaft Lock Plate (1×3锁片)	2
18	228-3201-143	Rubber Shaft Collar (轴箍)	14
19	228-3196-164	20mm Pulley (20mm 滑轮)	2
20	228-3196-165	30mm Pulley (30mm 滑轮)	2
21	228-3616-170	Mini Standoff Connector (Mini 撑柱连接头)	3
22	228-3196-213	12 Tooth Gear (12t 齿轮)	3
23	228-3196-214	36 Tooth Gear (36t 齿轮)	1
24	228-3201-223	50mm Diameter Rubber Belt (50mm 皮带)	2
25	228-2500-264	14x Shaft (14t 钢轴)	1
26	228-3448-451	36 Tooth Dog Gear (36t 惰齿轮)	1
27	228-2560	Smart Motor (智能电机)	1
28	228-2540	Robot Brain (主控器)	1
29	228-2604	Robot Battery (主控器电池)	1
30	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
31	228-2743	Robot Battery Charger (主控器电池充电器)	1
32	276-2520	Battery Charger Power Cord (充电器电缆)	1
33	228-2785	USB Cable (USB电缆)	1

表 18 旋转杯零件清单

教材第十九章案例——缝纫机

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-004	1x5 Beam (1×5直梁)	1
2	228-3616-013	1x14 Beam (1×14直梁)	2
3	228-3616-023	2x8 Beam (2×8直梁)	1
4	228-3616-025	2x10 Beam (2×10直梁)	2
5	228-3616-034	3x6 Plate (3×6矩形块)	1
6	228-3616-042	4x6 Plate (4×6 矩形块)	1
7	228-3616-051	6x12 Plate (6×12 矩形块)	1
8	228-3196-060	1x1 Connector Pin (1×1 销钉)	16
9	228-3943-065	1x Pitch Standoff (1× 撑柱)	1
10	228-3201-066	1.5x Pitch Standoff (1.5× 撑柱)	2
11	228-3445-114	0.25x Spacer (垫圈)	4
12	228-2500-120	4x Shaft (4× 钢轴)	1
13	228-3201-126	Large Chassis Corner Connector (大号底盘转角接头)	2
14	228-3449-128	2x Wide, 1x2 Corner Connector (2×宽, 1×2转角接头)	2
15	228-3448-133	2x Wide, 1x1 Offset Corner Connector (2×宽, 1×1位移转角接头)	2
16	228-3201-134	2x Wide, 2x2 Corner Connector (2×宽, 2×2转角接头)	8
17	228-3451-135	2x Wide, 1x2 Offset Corner Connector (2×宽, 1×2位移转角接头)	2
18	228-3450-140	2x2 Shaft Lock Plate (2×2锁片)	1
19	228-3201-143	Rubber Shaft Collar (轴箍)	11
20	228-3196-166	40mm Pulley (40mm 滑轮)	1
21	228-3196-213	12 Tooth Gear (12t 齿轮)	1
22	228-3196-214	36 Tooth Gear (36t 齿轮)	1
23	228-3446-233	16 Tooth Sprocket (16t 链轮)	2
24	228-2500-262	11x Shaft (11t 钢轴)	1
25	228-2500-263	12x Shaft (12t 钢轴)	1
26	228-2500-264	14x Shaft (14t 钢轴)	1
27	228-2500-272	Double 1x Wide, 2×1 Corner Connector (双头1×宽, 2×1转角接头)	1
28	228-1252	三头转角接头	2
29	228-2560	Smart Motor (智能电机)	1
30	228-2540	Robot Brain (主控器)	1
31	228-2604	Robot Battery (主控器电池)	1
32	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
33	228-2743	Robot Battery Charger (主控器电池充电器)	1
34	276-2520	Battery Charger Power Cord (充电器电缆)	1
35	228-2785	USB Cable (USB电缆)	1

表 19 缝纫机零件清单

教材第二十章案例——六足机器人

No. (序号)	Part Number (零件编号)	Part Name (零件名称)	Qty (零件数量)
1	228-3616-004	1x5 Beam (1×5直梁)	2
2	228-3616-005	1x6 Beam (1×6直梁)	2
3	228-3616-006	1x7 Beam (1×7直梁)	4
4	228-3616-008	1x9 Beam (1×9直梁)	6
5	228-3616-023	2x8 Beam (2×8直梁)	2
6	228-3616-026	2x12 Beam (2×12直梁)	2
7	228-3616-043	4x8 Plate (4×8 矩形块)	1
8	228-3201-066	1.5x Pitch Standoff (1.5× 撑柱)	2
9	228-3943-098	1x2 Idler Pin (1×2 惰轮销钉)	2
10	228-3445-114	0.25x Spacer (垫圈)	14
11	228-3201-126	Large Chassis Corner Connector (大号底盘转角连接头)	2
12	228-3449-128	2x Wide, 1x2 Corner Connector (2×宽, 1×2转角连接头)	4
13	228-3446-130	1x Wide, 1x1 Offset Corner Connector (1×宽, 1×1位移转角连接头)	6
14	228-3201-143	Rubber Shaft Collar (轴箍)	4
15	228-3196-214	36 Tooth Gear (36t 齿轮)	2
16	228-2560	Smart Motor (智能电机)	2
17	228-2540	Robot Brain (主控器)	1
18	228-2604	Robot Battery (主控器电池)	1
19	228-2780	Smart Cable(6-pack) (智能电缆6根套装)	1
20	228-2743	Robot Battery Charger (主控器电池充电器)	1
21	276-2520	Battery Charger Power Cord (充电器电缆)	1
22	228-2785	USB Cable (USB电缆)	1

表 20 六足机器人零件清单