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# A Project Planning

Calendar week	32	33	34	35	36	37	38	39	40	41	
Dates	8/08 -	15/08 -	22/08 -	29/08 -	05/09 -	12/09 -	19/09 -	26/09 -	3/10 -	10/10 -	
Dates	12/08	19/08	26/08	02/09	09/09	16/09	23/09	30/09	7/10	14/10	
Project week	1	2	3	4	5	6	7	8	9	10	
Company analysis											
Literature research											
Solar Home System principle											
Market & Competitors											
Explorative field research											
Project goal											
Assembly analysis old box											
Comparison old & new electronics											
Analysis small box proposal											
List of requirements											
Concept development boxes											
Prototype plan											
Prototype boxes											
Assembly analysis mounting system											
Workshop visits											
Design details boxes											
Transportation & Installation visits											
List of requirements											
Assembly test battery boxes											
Concept development boxes											
Prototype plan											
Prototype mounting system											
Installation test											
Optimization mounting system											
Align component designs											
Total system transport											
Documentation											
Recommendations											
Presentation poster											
Final presentation											
Supervisory meetings											
			Analysis					Вох			
				developr	ment			Mount			T
			Optimiza					Both			T
				& Present	ation			Other			T
											T

42	43	44	45-46	47	48	49	50	51	52-1	2	3	4	5	6
7/10 -	24/10 -	31/10 -	7/11 -	21/11 -	28/11 -	5/12 -	12/12 -	19/12 -			16/01 -	23/01 -	30/01 -	06/02
1/10	28/10	4/11	18/11		2/12	9/12	16/12				20/01		03/02	
reak	11	12	Break	13	14	15	16	17	Break	18	19	20	21	22

# B Cost price SHS

In the box on this page an overview of the cost price for both the regular and large SHS is visualized. The prices are derived from Kamworks' most recent unit cost (right page) and assembly list records (September 2016).

Materials	USD
Battery box: Box front Box back PCBs Charge controller Circuit breaker 3x Cigarette plug Cigarette plug box IEC Connector 4-Wire connector Battery Fasteners & wiring Accessoires Contracts & Manuals Bags and Boxes Stickers	\$4,5 / \$7 \$1,5 / \$5 \$35 \$7 / \$35,5 \$2,5 \$2,5 \$0,2 \$1,5 \$69 / \$96 \$15 \$6 \$4 \$3 \$0,5
Solar panel: Solar panel Mounting system Electric cable	\$39 / \$36 \$6 / \$15 \$12 / \$18
Lampkit: 4x 9W LED 4x Lamp holder 3x Light switch Electric cable	\$16 \$2 \$2 \$10
<b>Transport</b> Sre Ampil to Kampong Chhnang Installation	\$3 \$5
Labour Assembly Installation (2 installers)	\$4,5 \$10
Materials \$243,7 Transport & installation Labour:	/ <b>\$313,2</b> \$ 8 <b>\$14,5</b>
Production costs (including risk 2% for theft, loss, damage):	k margin
\$270,8 / \$342,4	



									1.7 Solar Assembly 100W	AS002	IGE006	IEC female plug	1 pcs	0,19	0,19	. 0. 1
O.1 Display Ass	Sub Assemb AS011	GE004	name Display board		unit pcs	cost/unit 0	Total cost 0	KW60W-V2 KW100W-V2 1 1	1.1 Powerb_100Ass	AS020	GE025	Microswitch	1 pcs	0,1	0,1	0 1
0.2 Sim ass 0.6 LampKit4	AS022 FP003	GE011 AS014	SIM board fastners Lampkit		pcs pcs	0	0	1 1	1.1 Powerb_100Ass 1.1 Powerb_100Ass	AS020 AS020	FS007 MC007	Faston ring 8mm blue Shrink tube 10mm²	2 pcs 2 cm	0,05	0,1 0,1	0 1
1.1 Powerb_100Ass	AS020	GE010	Power board	1	pcs	0	0	0 1	2.1 Powerb_60Ass 1.5 Fastners_100_Ass	AS021 AS015	GE028 MC002	Header strip Male Seal lead	10 pin	0,0005		1 0
1.1 Powerb_100Ass 1.3 Electronics 100 Ass	AS020 AS012	GE030 AS011	Resistor Display Ass		pcs pcs	0	0	0 1	2.1 Powerb_60Ass	AS021	GE028	Header strip Male	2 pcs 10 pin		0,005	1 0
1.3 Electronics_100_Ass	AS012	AS017	Flat cable ass 100		pcs	0	0	0 1	0.5 fastners Lampkit 0.3 solarin	AS014 AS023	FN021 CB007	Woodscrew 25x3 Wire black flexible 2.5mm2	20 pcs 45 cm	0,006	0,12	1 1
1.3 Electronics_100_Ass 1.3 Electronics_100_Ass	AS012 AS012	AS020 AS022	Powerb_100Ass Sim Ass	1	pcs pcs	0	0	0 1	0.3 solarin	AS023 AS015	CB008 FN017	Wire red flexible 2.5mm2 Ring M8 small	45 cm	0,0027	0,1215 0,1225	1 1
1.3 Electronics_100_Ass 1.4 Batterybox_100	AS012 AS008	IF026 AS012	Test form electronics Electronics_100_Ass		pcs pcs	0	0	0 1	1.5 Fastners_100_Ass 1.6 Box Assembly 100W - v2.0	AS001	IF002	Installation form	28 pcs 1 pcs	0,3	0,3	0 1
1.4 Batterybox_100	AS008	AS023	solarin	1	pcs	0	0	0 1	1.1 Powerb_100Ass  0.5 fastners Lampkit	AS020 AS014	IF031 GE017	serial sticker Power Wire connector small (red)	1 pcs 3 pcs	0,15	0,15 0,18	0 1
1.4 Batterybox_100 1.4 Batterybox_100	AS008 AS008	IF017 IF018	Sticker good solar brown Sticker good solar gold		pcs pcs	0	0	0 1	0.5 fastners Lampkit 2.6 Fastners_60_Ass	AS014 AS016	GE018 CM010	Wire connector big (yellow o	3 pcs	0,06		1 1
1.6 Box Assembly 100W - v2.0 1.6 Box Assembly 100W - v2.0	AS001 AS001	AS019 AS008	Phone charger ass	1	pcs	0	0	0 1	2.3 Electronics_60_Ass	AS013	CM010	plastic bag	1 pcs 1 pcs	0,01	0,01	1 0
1.6 Box Assembly 100W - v2.0	AS001	AS015	Batterybox_100 Fastners_100_Ass		pcs pcs	0	0	0 1	2.6 Fastners_60_Ass 2.4 Batterybox_60	AS016 AS009	FN018 IF014	Woodscrew 6x80 Sticker Cellcard	2 pcs 1 pcs	0,01	0,02	1 0
1.6 Box Assembly 100W - v2.0 1.6 Box Assembly 100W - v2.0	AS001 AS001	IF016 IF034	Sticker Good Loar Solar loar certificate		pcs pcs	0	0	0 1	2.4 Batterybox_60 1.5 Fastners_100_Ass	AS009 AS015	MT011 FN014	Aluminium antenna holder 2 Nut M8	1 pcs 20 pcs	0,02	0,02 0,19	1 0
1.6 Box Assembly 100W - v2.0	AS001	IF028	Wing card	1	pcs	0	0	0 1	0.3 solarin	AS023	GE009	IEC male connector (solar in)	1 pcs	0,19	0,19	1 1
1.8 Support Structure Assembly : 1.8 Support Structure Assembly :	AS003 AS003	MT001 MT002	Pole top 100W Sheet steel leg 101 degree		pcs pcs	0	0	0 1	2.1 Powerb_60Ass 2.1 Powerb_60Ass	AS021 AS021	FS001 FS005	Faston receptacle female blue Faston ring 6mm blue	2 pcs 2 pcs	0,01	0,02	1 0
1.8 Support Structure Assembly :	AS003	MT003	Sheet steel leg 98 degree	2	pcs	0	0	0 1	2.6 Fastners_60_Ass 2.6 Fastners_60_Ass	AS016 AS016	FN006 FN004	Bolt M8x50 Bolt M8x30	1 pcs 4 pcs	0,03	0,03	1 0
1.8 Support Structure Assembly . 1.8 Support Structure Assembly .	AS003 AS003	MT007 MT004	Pipe clamp 100W Steel pipe 1.5m	$\overline{}$	pcs pcs	0	0	0 1	1.5 Fastners_100_Ass	AS015	MC003	Seal wire	10 cm	0,02	0,2	0 1
1.9 100W SHS 1.9 100W SHS	FP001 FP001	AS001 AS002	Box Assembly 100W -v2.0 Solar Assembly 100W		pcs pcs	0	0	0 1	2.1 Powerb_60Ass 2.6 Fastners_60_Ass	AS021 AS016	GE008 FN001	IEC female connector (solar o Bolt M8x100	1 pcs 1 pcs	0,04	0,04	1 0
1.9 100W SHS	FP001	AS003	Support Structure Assembly 1	1	pcs	0	ő	0 1	2.3 Electronics_60_Ass 2.5 connection box	AS013 AS010	IF032 CB007	serial sticker Charge controll Wire black flexible 2.5mm2	1 pcs 20 cm	0,05	0,05 0,054	1 0
1.9 100W SHS 2.10 SHS 60W - v2.0	FP001 FP002	FP003 AS004	LampKit4 Box Assembly 60W - v2.0		pcs pcs	0	0	1 0	2.2 FlatCable ass 60	AS018	CB002	Flat cable	25 cm	0,0025	0,0625	1 0
2.10 SHS 60W - v2.0 2.10 SHS 60W - v2.0	FP002 FP002	AS006 FP003	Support Structure Assembly 6 LampKit4	1	pcs pcs	0	0	1 0	2.5 connection box 2.4 Batterybox_60	AS010 AS009	CB008 FN025	Wire red flexible 2.5 mm2 Screw PT4x20 (close 60W bo	25 cm 8 pcs	0,0027	0,0675	1 0
2.6 Fastners_60_Ass	AS016	MT005	Mounting bracket	2	pcs	0	0	1 0	2.6 Fastners_60_Ass	AS016	MC002	Seal lead	2	0,05	0,1	1 0
2.3 Electronics_60_Ass 2.6 Fastners_60_Ass	AS013 AS016	IF023 MT006	Sticker SHS60 box serial Pipe clamp 60W	2	pcs pcs	0	0	1 0	1.5 Fastners_100_Ass 1.1 Powerb_100Ass	AS015 AS020	FN002 CB011	Bolt M8x120 Wire Red flexible 0.75mm2	4 pcs 30 cm	0,07	0,28 0,3	0 1
2.3 Electronics_60_Ass 2.3 Electronics_60_Ass	AS013 AS013	IF024 IF025	Sticker SHS60 Install form Sticker SHS60 Warrantee		pcs pcs	0	0	1 0	0.6 LampKit4 2.6 Fastners_60_Ass	FP003 AS016	GE024 FN017	Box cover Ring M8 small	1 pcs 30 pcs	0,3	0,3	1 1
2.3 Electronics_60_Ass	AS013	IF026	Test form electronics	1	pcs	0	0	1 0	2.6 Fastners_60_Ass	AS016	FN014	Nut M8	15 pcs	0,0095	0,1425	1 0
2.7 Box Assembly 60W - v2.0 0.1 Display Ass	AS004 AS011	AS009 IF030	Batterybox_60 Serial sticker display		pcs pcs	0,0005	0,0005	1 0	2.6 Fastners_60_Ass 2.1 Powerb_60Ass	AS016 AS021	FN005 IF031	Bolt M8x40 serial sticker Power	5 pcs 1 pcs	0,03 0,15	0,15 0,15	1 0
2.4 Batterybox_60 0.2 Sim ass	AS009 AS022	AS023 IF029	solarin Serial sticker SIM	1	pcs pcs	0,0005	0,0005	1 0	2.7 Box Assembly 60W - v2.0	AS004	IF008	Warranty certificate	1 pcs	0,15	0,15	1 0
2.4 Batterybox_60	AS009	AS013	Electronics_60_Ass	1	pcs	0	0	1 0	1.6 Box Assembly 100W - v2.0 2.10 SHS 60W - v2.0	AS001 FP002	IF001 AS005	End user manual Solar Assembly 60W	1 pcs 1 pcs	0,4	0,4	0 1
2.4 Batterybox_60 2.4 Batterybox_60	AS009 AS009	IF009 IF010	Sticker KW 60W Sticker display 60W	1	pcs pcs	0	0	1 0	0.6 LampKit4 1.1 Powerb_100Ass	FP003 AS020	BX008 CB007	Carton box Lamp Wire black flexible 2.5mm2	1 pcs	0,4	0,4 0,4185	1 1
2.7 Box Assembly 60W - v2.0 2.4 Batterybox_60	AS004 AS009	AS010 IF017	connection box Sticker good solar brown	1	pcs pcs	0	0	1 0	1.5 Fastners_100_Ass	AS015	FN003	Bolt M8x20	16 pcs	0,03	0,48	0 1
0.1 Display Ass 0.1 Display Ass	AS011	GE028	Header strip Male Header strip Male	3	pin	0,0005	0,0015	1 1	0.4 Phone charger ass 2.1 Powerb_60Ass	AS019 AS021	GE029 MC007	Phone charger cable Shrink tube 10mm²	1 pcs 4 cm	0,57 0,05	0,57 0,2	1 1
2.4 Batterybox_60	AS011 AS009	GE028 IF018	Sticker good solar gold	1	pin pcs	0,0005	0,0015	1 1	2.6 Fastners_60_Ass	AS016	MC003	Seal wire	10 cm	0,02	0,2	1 0
2.7 Box Assembly 60W - v2.0 0.1 Display Ass	AS004 AS011	AS016 GE028	Fastners_60_Ass Header strip Male		pcs pin	0,0005	0,0025	1 0	1.1 Powerb_100Ass 0.6 LampKit4	AS020 FP003	CB010 FN019	Wire Black flexible 0.75mm2 Cable clip small (1box of 100	60 cm 1 pcs	0,01	0,6	1 1
0.1 Display Ass	AS011 AS022	GE028 GE028	Header strip Male		pin pin	0,0005	0,0025	1 1	2.6 Fastners_60_Ass	AS016	FN007 CB007	Bolt M8x60	4 pcs	0,05	0,2	1 0
0.2 Sim ass 1.4 Batterybox_100	AS008	IF006	Header strip Male Sticker KW 100W		pin	0,0005	0,004	0 1	2.1 Powerb_60Ass 0.6 LampKit4	AS021 FP003	GE014	Wire black flexible 2.5 mm2 Double switch	### cm 1 pcs	0,0027	0,27 0,6	1 1
1.1 Powerb_100Ass 1.1 Powerb_100Ass	AS020 AS020	GE028 GE028		10		0,0005	0,005	0 1	2.7 Box Assembly 60W - v2.0 2.1 Powerb_60Ass	AS004 AS021	IF002 CB010	Installation form Wire Black flexible 0.75mm2	1 pcs 33 cm	0,3	0,3	1 0
0.1 Display Ass 0.1 Display Ass	AS011 AS011	GE028 GE028	Header strip Male	10 10	pin	0,0005	0,005 0,005	1 1	2.1 Powerb_60Ass	AS021	CB011	Wire Red flexible 0.75mm2	33 cm	0,01	0,33	1 0
1.3 Electronics_100_Ass	AS012	IF021	Sticker SHS100 Install form	1	pcs	0,05	0,05	0 1	2.9 Support Structure Assembly ( 2.1 Powerb 60Ass	AS006 AS021	FN002 CB008	Bolt M8x120 Wire red flexible 2.5mm2	5 pcs	0,0027	0,35 0,3645	1 0
1.3 Electronics_100_Ass 0.2 Sim ass	AS012 AS022	IF022 GE028	Sticker SHS100 Warrantee Header strip Male	10	pcs pin	0,05	0,05	0 1	1.3 Electronics_100_Ass	AS012 AS008	GE020 MC001	Antenna cable (plus ring & bo	1 pcs	0,65	0,65	0 1
0.5 fastners Lampkit 0.1 Display Ass	AS014 AS011	CM012 GE027	Plastic bag 5x5 Header strip female	1 8	pcs nin	0,005	0,005	1 1	1.4 Batterybox_100 2.7 Box Assembly 60W - v2.0	AS008	IF001	Rubber tube End user manual	6 pcs 1 pcs	0,11 0,4	0,66 0,4	1 0
0.1 Display Ass	AS011	GE027	Header strip female	10	pin	0,00083	0,00825	1 1	2.5 connection box 1.1 Powerb_100Ass	AS010 AS020	GE001 CB008	Cigarette lighter socket Wire red flexible 2.5mm2	2 pcs 250 cm	0,28	0,56 0,675	0 1
1.3 Electronics_100_Ass 1.5 Fastners_100_Ass	AS012 AS015	CM010 CM011	Plastic bag Plastic bag 10x10	1	pcs pcs	0,01 0,01	0,01 0,01	0 1	1.6 Box Assembly 100W - v2.0	AS001	BX006	Carton box 100W	1 pcs	0,7	0,7	0 1
0.4 Phone charger ass 1.4 Batterybox 100	AS019 AS008	CM011 CB007	Plastic bag 10x10 Wire black flexible 2.5mm2	4	pcs cm	0,01	0,01	0 1	1.3 Electronics_100_Ass 2.7 Box Assembly 60W - v2.0	AS012 AS004	GE019 BX007	Antenna Carton box 60W	1 pcs 1 pcs	0,75	0,75 0,6	1 0
1.4 Batterybox_100 2.7 Box Assembly 60W - v2.0	AS008 AS004	CB008 AS019	Wire red flexible 2.5mm2 Phone charger ass	4	cm pcs	0,0027	0,0108	0 1	2.3 Electronics_60_Ass	AS013 AS009	GE020 MC001	Antenna cable (plus ring & bo Rubber tube	1 pcs	0,65	0,65 0,66	1 0
2.9 Support Structure Assembly	AS006	MT008	Aluminium angle bracket 28,	1	pcs	0	0	1 0	2.4 Batterybox_60 2.3 Electronics_60_Ass	AS013	GE019	Antenna	6 pcs 1 pcs	0,11 0,75	0,75	1 0
2.9 Support Structure Assembly ( 1.4 Batterybox_100	AS006 AS008	MT009 IF005	Sheet steel rectangular 2x4x6 Sticker display 100W	1	pcs pcs	0,015	0,015	0 1	0.4 Phone charger ass 0.6 LampKit4	AS019 FP003	GE021 GE023	SHS phone charger Base box	1 pcs 4 pcs	0,8		1 1
1.4 Batterybox_100 1.4 Batterybox_100	AS008 AS008	IF014 MT011	Sticker Cellcard Aluminium antenna holder 2		pcs pcs	0,02	0,02	0 1	0.3 solarin	AS023	FS010	Faston wire end pipe red	2 pcs	0,42	0,84	1 1
2.9 Support Structure Assembly	AS006	MT010	Sheet steel square 3x3x33.5c	2	pcs	0,02	0,02	1 0	1.4 Batterybox_100 1.4 Batterybox_100	AS008 AS008	GE001 FN011	Cigarette lighter socket Nickelized bolt M3x20	3 pcs 12 pcs	0,28	0,84 0,96	0 1
2.9 Support Structure Assembly ( 2.7 Box Assembly 60W - v2.0	AS006 AS004	MT012 IF034	Steel pipe diameter 3.5cm - 1 Solar loar certificate		pcs pcs	0	0	1 0	1.7 Solar Assembly 100W 1.2 FlatCable ass 100	AS002 AS017	MC007 GE026	Shrink tube 10mm <sup>2</sup> box connector (for flat cable)	20 cm 2 pcs	0,05	1	0 1
2.7 Box Assembly 60W - v2.0 2.7 Box Assembly 60W - v2.0	AS004 AS004	IF028 IF016	Wing card Sticker Good Loar		pcs	0	0	1 0		A3017		Screw PT3x15 (Microswitch)				0 1
2.1 Powerb_60Ass 2.1 Powerb_60Ass	AS021 AS021	GE010 GE030	Power board			0	0		1.4 Batterybox_100	AS008	FN026			0,5	1	1 0
2.3 Electronics_60_Ass	AS013			1	pcs pcs	0	0	1 0	1.4 Batterybox_100 2.2 FlatCable ass 60 2.5 connection box	AS008 AS018 AS010	FN026 GE026 BX005	box connector (for flat cable) Connection box 10cmx10cm	2 pcs 2 pcs 1 pcs	0,5 0,5 1,1	1 1 1,1	1 0
2.3 Electronics_60_Ass 2.3 Electronics 60 Ass	AS013	AS011	Resistor Display Ass	4	pcs pcs pcs pcs	0 0 0	0 0	1 0 1 0 1 0	2.2 FlatCable ass 60 2.5 connection box 2.4 Batterybox_60	AS018 AS010 AS009	GE026 BX005 FN011	box connector (for flat cable) Connection box 10cmx10cm Nickelized bolt M3x20	2 pcs 1 pcs 14 pcs	0,5 1,1 0,08	1,1 1,12	1 0
1.4 Batterybox_100	AS013	AS011 AS018 AS021	Resistor	1 4 1	pcs pcs pcs	0 0 0 0	0	1 0 1 0 1 0 1 0 1 0 1 0	2.2 FlatCable ass 60 2.5 connection box 2.4 Batterybox_60 1.4 Batterybox_100 0.6 LampKit4	AS018 AS010 AS009 AS008 FP003	GE026 BX005 FN011 FN012 GE013	box connector (for flat cable) Connection box 10cmx10cm Nickelized bolt M3x20 Nickelized nut M3 Single switch	2 pcs 1 pcs 14 pcs 12 pcs 2 pcs	0,5 1,1 0,08 0,09 0,6	1 1,1 1,12 1,08 1,2	1 0 0 1
	AS013 AS008	AS018 AS021 FN010	Resistor Display Ass FlatCable ass 60 Powerb_60Ass Galvanized ring M4	1 4 1 1 1 4	pcs pcs pcs pcs pcs pcs	0,01	0 0 0,04	1 0 1 0 1 0 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1	2.2 FlatCable ass 60 2.5 connection box 2.4 Batterybox 60 1.4 Batterybox 100 0.6 LampKit4 2.4 Batterybox 60 0.6 LampKit4	AS018 AS010 AS009 AS008 FP003 AS009 FP003	GE026 BX005 FN011 FN012 GE013 FN012 GE015	box connector (for flat cable) Connection box 10cmx10cm Nickelized bolt M3x20 Nickelized nut M3	2 pcs 1 pcs 14 pcs 12 pcs 2 pcs 14 pcs 4 pcs	0,5 1,1 0,08 0,09 0,6 0,09 0,3	1 1,1 1,12 1,08 1,2 1,26 1,2	1 C C C C C C C C C C C C C C C C C C C
1.3 Electronics_100_Ass	AS013 AS008 AS013 AS012	AS018 AS021 FN010 AS022 IF020	Resistor Display Ass FlatCable ass 60 Powerb_60Ass Galvanized ring M4 Sim Ass Sticker SHS100 box serial	1 4 1 1 1 4 1	pcs pcs pcs pcs pcs pcs pcs pcs	0,01 0 0,05	0 0,04 0,05	1 0 1 1 0 1 1 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0	2.2 FlatCable ass 60 2.5 connection box 2.4 Batterybox_60 1.4 Batterybox_100 0.6 LampKit4 2.4 Batterybox_60	AS018 AS010 AS009 AS008 FP003 AS009	GE026 BX005 FN011 FN012 GE013 FN012	box connector (for flat cable) Connection box 10cmx10cm Nickelized both M3x20 Nickelized nut M3 Single switch Nickelized nut M3	2 pcs 1 pcs 14 pcs 12 pcs 2 pcs 14 pcs 4 pcs 2 pcs	0,5 1,1 0,08 0,09 0,6 0,09 0,3	1,12 1,12 1,08 1,2	1 C C C C C C C C C C C C C C C C C C C
1.3 Electronics_100_Ass 1.7 Solar Assembly 100W 1.3 Electronics_100_Ass	AS013 AS008 AS013 AS012 AS002 AS012	AS018 AS021 FN010 AS022 IF020 IF019 IF032	Resistor Display Ass FlatCable ass 60 Powerb_60Ass Galvanized ring M4 Sim Ass Sticker SHS100 box serial Sticker High Voltage warning serial sticker Charge controlle	1 4 1 1 1 4 1 1 1	pcs	0,01 0,05 0,15 0,05	0 0,04 0 0,05 0,15 0,05	1 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 0 1 1 0	2.2 FlatCable ass 60 2.5 connection box 2.4 Batterybox, 60 1.4 Batterybox, 100 0.6 LampRit4 2.4 Batterybox, 60 0.6 LampRit4 2.7 Box Assembly 60W - v2.0 2.5 connection box 2.7 Box Assembly 60W - v2.0	AS018 AS010 AS009 AS008 FP003 AS009 FP003 AS004 AS010 AS004	GE026 BX005 FN011 FN012 GE013 FN012 GE015 GE002 GE012 IF003	box connector (for flat cable) Connection box 10cmx10cm Nickelized bot M3x20 Nickelized nut M3 Single switch Nickelized nut M3 Lamp holder E27 Cigarette plug Terminal connector block 4 s Sign installed by KW	2 pcs 1 pcs 14 pcs 12 pcs 2 pcs 14 pcs 4 pcs 2 pcs 1 pcs 1 pcs	0,5 1,1 0,08 0,09 0,6 0,09 0,3 0,71 1,5	1 1,12 1,08 1,2 1,26 1,26 1,42 1,5 1,5	1 C C C C C C C C C C C C C C C C C C C
1.3 Electronics_100_Ass 1.7 Solar Assembly 100W	AS013 AS008 AS013 AS012 AS002	AS018 AS021 FN010 AS022 IF020 IF019	Resistor Display Ass FlatCable ass 60 Powerb_60Ass Galvanized ring M4 Sim Ass Sticker SHS100 box serial Sticker High Voltage warning	1 4 1 1 4 1 1 1 1 1	pcs	0,01 0,05 0,15	0 0,04 0,05 0,05	0 1	2.2 FilatCable ass 60 2.5 cannection box 2.4 Batterybox, 60 1.4 Batterybox, 100 0.6 LampKit4 2.4 Batterybox, 60 0.6 LampKit4 2.7 Box Assembly 60W - v2.0 2.7 Box Assembly 60W - v2.0 2.4 Batterybox, 60 2.2 Box Casterybox, 60 2.2 Box Casterybox, 60 2.2 Box Casterybox, 60 2.2 Box Casterybox, 60 2.2 Howerb, 60Mss	AS018 AS010 AS009 AS008 FP003 AS009 FP003 AS004 AS010 AS004 AS009 AS021	GE026 BX005 FN011 FN012 GE013 FN012 GE015 GE002 GE012 IF003 BX003 FS010	box connector (for flat cable) Connection box 10cmx10cm Nickelized bolt M3x20 Nickelized nut M3 Single switch Nickelized nut M3 Lamp holder E27 Cigarette plug Terminal connector block 4 s Sign installed by KW Battery box 60W back Faston wire end pipe red	2 pcs 1 pcs 14 pcs 12 pcs 2 pcs 14 pcs 4 pcs 2 pcs 1 pcs 1 pcs 1 pcs 1 pcs 1 pcs 1 pcs 4 pcs	0,5 1,1 0,08 0,09 0,6 0,09 0,3 0,71 1,5 1,67	1 1,1 1,12 1,08 1,26 1,26 1,42 1,42 1,5 1,5 1,67	1 C C C C C C C C C C C C C C C C C C C
1.3 Electronics_100_Ass 1.7 Solar Assembly 100W 1.3 Electronics_100_Ass 1.3 Electronics_100_Ass 1.4 Batterybox_100 1.5 Fastners_100_Ass	AS013 AS008 AS013 AS012 AS002 AS012 AS012 AS012 AS008 AS015	AS018 AS021 FN010 AS022 IF020 IF019 IF032 IF033 IF004 FN016	Resistor Display Ass FlatCable ass 60 Powerb_60Ass Galvanized ring M4 Sim Ass Sticker SHS100 box serial Sticker High Voltage warning serial sticker Charge controll Sticker ++- Ring M8 big	1 4 1 1 4 1 1 1 1 1 1 1 1 4	pcs	0,01 0,05 0,15 0,05 0,05 0,05 0,0175	0 0,04 0,05 0,15 0,05 0,05 0,05 0,05	0 1	2.2 FlotCable ass 60 2.5 cannection box 2.4 Batterybox, 60 1.1 Batterybox, 100 0.6 LampKit4 2.4 Batterybox, 60 0.6 LampKit4 2.7 Bax Assembly 60W - v2.0 2.5 cannection box 2.7 Bax Assembly 60W - v2.0 2.1 Bax Exercision box 2.1 Bax Exercision box 2.2 Bax Exercision box 2.2 Bax Exercision box 2.2 Bax Exercision box 2.3 Bax Exercision box 2.4 Bax	AS018 AS010 AS009 AS008 FP003 AS009 FP003 AS004 AS010 AS004 AS009 AS009 AS009 AS001	GE026 BX005 FN011 FN012 GE013 FN012 GE015 GE002 GE012 IF003 BX003	box connector (for flat cable) Connection box Jonaviora Nickelized bolt M3x20 Nickelized nut M3 Single switch Nickelized nut M3 Lamp holder fiz Cigarette plug Terminal connector block 4 s Sign insailed by KW Battery box 60W back Faston wire end pipe red Circuit breaker 10A Cigarette plug Cigarette plug	2 pcs 1 pcs 14 pcs 12 pcs 2 pcs 14 pcs 4 pcs 2 pcs 1 pcs 1 pcs 1 pcs 1 pcs	0,5 1,1 0,08 0,09 0,6 0,09 0,3 0,71 1,5 1,67 0,42 2,26	1 1,1 1,12 1,08 1,26 1,26 1,42 1,42 1,5 1,5	1
1.3 Electronics_100_Ass 1.7 Solar Assembly 100W 1.3 Electronics_100_Ass 1.3 Electronics_100_Ass 1.4 Batterybox_100 1.5 Fastners_100_Ass 1.2 FlatCable ass 100 1.6 Box Assembly 100W - v2.0	AS013 AS008 AS013 AS012 AS002 AS012 AS012 AS012 AS018 AS015 AS017 AS001	AS018 AS021 FN010 AS022 IF020 IF019 IF032 IF033 IF004 FN016 CB002 IF008	Resistor Display Ass FlatCable ass 60 Powerb_60Ass Galvanized ring M4 Sim Ass Sticker Hish Voltage warning serial sticker high Voltage warning serial sticker horage controll Sticker electronic assembly Sticker ++- Ring M8 big Flat cable Warnanty certificate	1 4 1 1 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1	pcs	0,01 0,05 0,15 0,05 0,05 0,05 0,0175 0,0025	0 0,04 0,05 0,15 0,05 0,05 0,05 0,07 0,075	0 1	2.2 FlotCable ass 60 2.5 connection box 2.4 Batterybox, 60 1.4 Batterybox, 60 1.4 Batterybox, 100 0.6 LompKit4 2.7 Box Assembly 60W - v.2.0 2.5 Connection box 2.7 Box Assembly 60W - v.2.0 2.8 Box Assembly 60W - v.2.0 2.4 Batterybox, 60 2.1 Powerb, 60Ass 2.4 Batterybox, 60 1.6 Box Assembly 10W - v.2.0 1.6 Box Assembly 10W - v.2.0 1.6 Box Assembly 10W - v.2.0	AS018 AS010 AS009 AS008 FP003 AS009 FP003 AS004 AS010 AS004 AS010 AS009 AS021 AS009 AS001 AS009	GE026 BX005 FN011 FN012 GE013 FN012 GE015 GE002 GE012 IF003 BX003 FS010 GE007 GE002 GE012	box connector (for flat cable) Connection box (Jema10cm Nickelized bolt M3:20 Nickelized hut M3:20 Nickelized hut M3 Single switch Nickelized nut M3 Lump holder E27 Cigarette plug Terminal connector block 4:5 Sign installed by KW Battery box 60W back Faston wire end piper end Circuit breaker 10A Cigarette plug Terminal connector block 4:5 Cigarette plug	2 pcs 1 pcs 12 pcs 12 pcs 2 pcs 14 pcs 4 pcs 2 pcs 1 pcs	0,5 1,1 0,08 0,09 0,6 0,09 0,3 0,71 1,5 1,67 0,42 2,26 0,71 1,5	1 1,1 1,12 1,08 1,2 1,26 1,26 1,5 1,5 1,67 1,67 1,68 2,26 1,42	1 0
1.3 Electronics_100_Ass 1.7 Solar Assembly 100W 1.3 Electronics_100_Ass 1.3 Electronics_100_Ass 1.4 Batterybox_100 1.5 Fastners_100_Ass 1.2 FlatCoble ass 100	AS013 AS008 AS013 AS012 AS002 AS012 AS012 AS012 AS015 AS015 AS017 AS001 AS020	AS018 AS021 FN010 AS022 IF020 IF019 IF032 IF033 IF004 FN016 CB002	Resistor Display Ass FlatCable ass 60 Powerb, 60Ass Galvanized ring M4 Sirches SHS100 box serial Sticker High Voltage warning serial sticker Charge controlle Sticker electronic assembly Sticker +1. Ring M8 big Flat cable	1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	pcs	0,01 0,05 0,15 0,05 0,05 0,05 0,0175	0 0,04 0,05 0,15 0,05 0,05 0,05 0,07	0 1	2.2 FlotCable ass 60 2.5 connection box 2.4 Batterybox, 60 1.4 Batterybox, 60 1.1 Batterybox, 100 0.5 LampKit4 2.4 Batterybox, 60 0.6 LampKit4 2.7 Box Assembly 60W - v2.0 2.5 connection box 2.7 Box Assembly 60W - v2.0 2.4 Batterybox, 60 2.1 Powerb, 60Ass 2.4 Batterybox, 60 1.6 Box Assembly 100W - v2.0	AS018 AS010 AS009 AS008 FP003 AS009 FP003 AS004 AS010 AS004 AS009 AS001 AS009 AS001 AS008 AS008 AS008 AS008	GE026 BX005 FN011 FN012 GE013 FN012 GE015 GE002 GE012 IF003 BX003 FS010 GE007 GE007 GE002 GE012 IF003 FS010	box connector (for flat cable) Connection box Jones 10 Feb. Nickelized hut M3:20 Nickelized hut M3:20 Nickelized hut M3 Single switch Nickelized hut M3 Single switch Nickelized hut M3 Lump holder E27 Cigarette plug Terminal connector block 4:5 Sign installed by KW Battery box 500 Feb. Size of M3:20 Feb. Size of M3:2	2 pcs 1 pcs 14 pcs 12 pcs 14 pcs 2 pcs 14 pcs 4 pcs 2 pcs 1 pcs 4 pcs 1 pcs 1 pcs 4 pcs 1 pcs 4 pcs 1 pcs 1 pcs 4 pcs 1 pcs 1 pcs 1 pcs 1 pcs 4 pcs	0,5 1,11 0,08 0,09 0,66 0,09 0,3 0,71 1,5 1,67 0,42 2,26 0,71 1,5 1,5 1,5 1,5 1,6 1,6 1,6 1,6 1,6 1,6 1,6 1,6 1,6 1,6	1 1,12 1,26 1,26 1,26 1,42 1,5 1,5 1,67 1,68 2,26 1,42 1,5 1,5 1,68	1 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0
1.3 Electronics, 100, Ass 1.7 Solar Assembly 100W 1.3 Electronics, 100, Ass 1.3 Electronics, 100, Ass 1.4 Electronics, 100, Ass 1.4 Fatterphox, 100 1.5 Fastners, 100, Ass 1.2 FlatCable ass 100 1.1 Fowerb, 100Ass 1.4 Batterphox, 100	AS013 AS008 AS013 AS012 AS002 AS012 AS012 AS015 AS015 AS017 AS001 AS001 AS001 AS001 AS000 AS008	AS018 AS021 FN010 AS022 IF020 IF019 IF032 IF033 IF004 FN016 C8002 IF008 FS001 FN008 FN009	Resistor Display Ass FlatChale ass 60 Sin Ass Sticker SH500 box serial Sticker SH500 box serial Sticker High Voltage warning serial sticker Charge controlle Sticker High Bob By Hart abile Warranty certificate Faston receptacle female blue Galvanized bott M4:20 Galvanized bott M4:20 Galvanized bott M4:20	1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	pcs	0,01 0,05 0,05 0,05 0,05 0,05 0,0175 0,0025 0,015 0,01 0,01	0 0,04 0,05 0,05 0,05 0,05 0,05 0,05 0,0	0 1	2.2 FlotCable ass 60 2.2 Sannection box 2.4 Batterybox, 60 1.4 Batterybox, 100 0.5 LampKit4 2.4 Batterybox, 60 0.5 LampKit4 2.7 Box Assembly 60W - v.2.0 2.5 connection box 2.7 Box Assembly 60W - v.2.0 2.4 Batterybox, 60 2.1 Powerb, 60Ass 2.4 Batterybox, 60 1.6 Box Assembly 100W - v.2.0 1.6 Box Assembly 100W - v.2.0 1.4 Batterybox, 100 1.6 Box Assembly 100W - v.2.0	AS018 AS010 AS009 AS009 AS009 AS009 AS004 AS010 AS004 AS010 AS004 AS010 AS004 AS008 AS008 AS008 AS008 AS008 AS008 AS008	GE026 BX005 FN011 FN012 GE013 FN012 GE015 GE002 GE012 IF003 BX003 FS010 GE007 GE002 GE012 IF003 FS010 GE007 IF003 FS010	box connector (for flat cable) Connection box Jonem Jorem Nickelized hut M3:20 Nickelized hut M3:20 Nickelized hut M3 Single switch Nickelized hut M3 Lump holder E27 Cigarette plug Terminal connector block 4:5 Sign installed by KW Faston wire end piper ed Circuit breaker 10A Sign installed by KW Faston wire end piper ed Circuit breaker 10A Cigarette plug Certain connector block 4:5 Sign installed by KW Faston wire end piper ed Circuit breaker 10A	2 pcs 1 pcs 14 pcs 12 pcs 2 pcs 14 pcs 4 pcs 1 pcs	0,5 1,1,1 0,08 0,09 0,6 0,09 0,3 0,71 1,5 1,67 0,42 2,26 0,71 1,5 1,5 1,5 2,2,6 0,7,1 2,2,6 0,7,1 2,2,6 2,2,6 2,2,6 2,2,6 2,2,6 2,2,6 2,2,6 2,6	1 1,12 1,08 1,26 1,26 1,27 1,55 1,57 1,57 1,58 1,59 1,59 1,59 1,59 1,59 1,59 1,59 1,59	1 C
1.3 Electronics, 100 Ass 1.7 Solar Assembly 100W 1.3 Electronics, 100 Ass 1.3 Electronics, 100 Ass 1.4 Batterybox, 100 1.5 Fastners, 100, Ass 1.2 FlotCoble ass 100 1.6 Box Assembly 100W - v2.0 1.1 Flowerb, 100Mss 1.4 Batterybox, 100 1.7 Solar Assembly 100W 1.1 Solar Assembly 100W 1.1 Flowerb, 100Mss	AS013 AS008 AS013 AS012 AS012 AS012 AS012 AS015 AS017 AS001 AS020 AS008 AS008 AS008 AS008 AS008 AS008 AS008 AS008 AS008 AS008 AS008 AS008 AS008 AS017	AS018 AS021 FN010 AS022 IF020 IF019 IF032 IF033 IF004 FN016 CB002 IF008 FS001 FN009 GE006 GE025	Resistor Display Ass FlatChele ass 60 Sinches Schools Sitcher SF\$100 box serial Sitcher SF\$100 box serial Sitcher High Yoldeng warning serial sitcher Charge controlle Sitcher Gelectronic assembly Sitcher High Yoldeng warning High Big FlatCable Warranty certificate Faston receptoric female blue Galvanized bott M4x20 Galvanized mut M4 IEC female plug Mtcroswitch	1 4 1 1 1 1 1 1 1 1 1 1 1 1 4 30 1 8 9 9	pcs	0,01 0 0,05 0,15 0,05 0,05 0,07 0,0175 0,0025 0,15 0,01 0,01 0,01 0,01 0,19 0,19	0 0,04 0,05 0,05 0,05 0,05 0,05 0,07 0,075 0,075 0,08 0,09 0,09	0 1	2.2 FiotCable ass 60 2.5 connection box 2.4 Batterybox, 60 1.4 Batterybox, 100 0.6 LampKit 2.4 Batterybox, 100 0.6 LampKit 2.7 Bax Assembly 60W - v.2.0 2.5 connection box 2.7 Bax Assembly 60W - v.2.0 2.1 Powerb, 60Ass 2.4 Batterybox, 60 2.1 Powerb, 60Ass 2.4 Batterybox, 60 1.1 Bax Assembly 100W - v.2.0 1.4 Batterybox, 100 1.6 Bax Assembly 100W - v.2.0 1.6 Bax Assembly 100W - v.2.0 1.1 Bax Assembly 100W - v.2.0	AS018 AS010 AS009 AS009 FP003 AS004 AS010 AS010 AS010 AS010 AS009 AS021 AS009 AS021 AS009 AS001 AS008 AS008 AS008	GE026 BX005 FN011 FN012 GE013 FN012 GE015 GE002 GE012 IF003 BX003 FS010 GE007 GE002 GE012 IF003 FS010 GE007 GE002 GE012	box connector (for flat cable) Connection box Jonem30cm Nickelized bolt M3:20 Nickelized bott M3:20 Nickelized nut M3 Single switch Nickelized nut M3 Lamp holder E27 Cigarette plug Terminal connector block 4:5 Sign installed by KW Battery box 60W back Faston wire end piper ed Circuit breaker 10A Cigarette plug Terminal connector block 4:5 Sign installed by KW Faston wire end piper ed Circuit breaker 10A Cigarette plug Terminal connector block 4:5 Sign installed by KW Faston wire end piper ed Circuit breaker 10A Solar folder Solar folder	2 pcs 1 pcs 14 pcs 12 pcs 2 pcs 14 pcs 2 pcs 14 pcs 1 pcs	0,5 1,11 0,08 0,09 0,66 0,09 0,3 0,71 1,5 1,67 0,42 2,26 0,71 1,5 1,5 1,6,7 0,42 2,26	1 1,12 1,12 1,18 1,19 1,19 1,19 1,19 1,19 1,19 1,19	1 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0
1.3 Electronics, 100 Ass 1.7 Solar Assembly 100W 1.3 Electronics, 100 Ass 1.3 Electronics, 100 Ass 1.4 Batterybox, 100 1.5 Fastners, 100, Ass 1.2 FlotCable ass 100 1.6 Box Assembly 100W - v2.0 1.1 Flowerb, 100Mss 1.4 Batterybox, 100 1.7 Solar Assembly 100W 1.7 Solar Assembly 100W 1.1 Flowerb, 100Mss 1.1 Flowerb, 100Ass 1.1 Flowerb, 100Ass 1.1 Powerb, 100Ass	AS013 AS008 AS013 AS012 AS012 AS012 AS012 AS015 AS017 AS001 AS020 AS008 AS008 AS008 AS008	AS018 AS021 FN010 AS022 IF020 IF019 IF032 IF033 IF004 FN016 CB002 IF008 FN009 GE006	Resistor Display Ass FlatCable ass 60 Fowerb_60Ass Galvanized ring M4 Sim Ass Sitcker High Voltage warring sirist sitcker flage controlle Sticker electronic assembly Sticker High Voltage warring Tlat Cable Warranty certificate Faston receptacle femal bibut Galvanized both M4220 Galvanized both M4220 Galvanized nut M4 Et Cernale plug	1 4 1 1 1 1 1 1 1 1 1 1 1 1 4 30 1 8 9 9	pcs	0,01 0,05 0,05 0,05 0,05 0,05 0,0175 0,0025 0,017 0,01 0,01	0 0,04 0,05 0,05 0,05 0,05 0,07 0,07 0,07 0,07	0 1	2.2 FiotCoble ass 60 2.2 Sonnection box 2.4 Batterybox, 60 1.4 Batterybox, 60 1.6 Batterybox, 60 0.6 Lampkit4 2.7 Box Assembly 60W - v2.0 2.5 Sonnection box 2.7 Box Assembly 60W - v2.0 2.1 Powerb, 60Ass 2.4 Batterybox, 60 2.1 Powerb, 60Ass 2.4 Batterybox, 60 1.1 Powerb, 60Ass 4.4 Batterybox, 60 1.1 Box Assembly 100W - v2.0 1.4 Batterybox, 100 1.4 Batterybox, 100 1.4 Box Assembly 100W - v2.0 1.1 Powerb, 100W - v2.0 1.2 Powerb, 100W - v2.0 1.2 Powerb, 100W - v2.0 1.2 Powerb, 100W - v2.0 1.1 Powerb, 100W - v2.0 1.1 Powerb, 100Ass 2.7 Box Assembly 60W - v2.0 1.1 Powerb, 100Ass 2.5 Sonnection box	AS018 AS010 AS009 AS009 FP003 AS004 AS004 AS004 AS009 AS009 AS001 AS001 AS001 AS001 AS001 AS003 AS001 AS003 AS003 AS001 AS003 AS003 AS003 AS003 AS003 AS004 AS003 AS004 AS003 AS004 AS005 AS004 AS005 AS004 AS004 AS004 AS004 AS004 AS004 AS005 AS004 AS005 AS004 AS005 AS006 AS006 AS006 AS007	GE026 BX005 FN011 FN011 FN012 GE013 FN012 GE013 GE002 GE015 GE002 GE012 IF003 FS010 GE007 GE002 GE012 IF003 IF003 FS010 GE007 IF035 IF035 IF035 FS010	box connector (for flat cable) Connection box Jomen Jore Nickelized bolt M3:20 Nickelized host M3:20 Nickelized nut M3 Single switch Nickelized nut M3 Lamp holder E27 Gigarette plug Terminal connector block 4:5 Sign installed by KW Battery box 60W back Faston wire end pipe red Circuit breaker IOA Gigarette plug Terminal connector block 4:5 Sign installed by KW Faston wire end pipe red Circuit breaker IOA Sign installed by KW Faston wire end pipe red	2 pcs 1 pcs 14 pcs 12 pcs 2 pcs 14 pcs 2 pcs 14 pcs 1 pcs 8 pcs 1 pcs	0,5 1,1,088 0,088 0,099 0,6 0,71 1,5 1,67 0,42 2,26 0,71 1,5 1,5 1,67 0,71 1,5 2,26 2,26 2,26 2,26 2,26 2,26 2,26 2,	1 1,11 1,12 1,08 1,12 1,12 1,12 1,12 1,12 1,12 1,12 1,1	1 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0
1.3 Electronics, 100 Ass 1.7 Solar Assembly 100W 1.3 Electronics, 100 Ass 1.3 Electronics, 100 Ass 1.3 Electronics, 100 Ass 1.5 Fastners, 100 Ass 1.5 Fastners, 100 Ass 1.6 Box Assembly 100W v.2.0 1.6 Box Assembly 100W v.2.0 1.4 Botterybox, 100 1.7 Solar Assembly 100W 1.1 Powerb, 100Ass 1.1 Powerb, 100Ass 1.1 Powerb, 100Ass 1.1 Powerb, 100Ass 1.1 Powerb, 100Ass 1.2 Powerb, 100Ass	AS013 AS008 AS012 AS012 AS012 AS012 AS012 AS015 AS015 AS015 AS015 AS015 AS010 AS020 AS020 AS020 AS020 AS020 AS020 AS020 AS020	AS018 AS021 FN010 AS022 IF020 IF019 IF033 IF004 FN016 CB002 IF008 FS001 FN008 FN009 GE006 GE025 FS007	Resistor Display Ass FlatChale ass 60 FlatChale ass 60 FlatChale ass 60 Galvanized ring M4 Sim Ass Sticker High Voltage warning errist sticker Charge controlle Sticker electronic assembly Sticker High Voltage warning Flat cable Warranty certificate Faston receptacle female blue Galvanized nut M4:20 Galvanized nut M4:20 Galvanized nut M4:20 Galvanized m4 IEC female plug Microswitch Flaton ring Romm blue Shrink tube 10 mm² Heeder strip Male	1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	pcs	0,01 0,05 0,05 0,05 0,05 0,015 0,002 0,15 0,017 0,01 0,01 0,01 0,01 0,01 0,01 0,0	0 0,04 0,05 0,15 0,05 0,05 0,07 0,07 0,07 0,15 0,08 0,09 0,09 0,19	0 1 0 0 1 0 1 0 0 1	2.2 FiotCable ass 60 2.2 Sonnection box 2.4 Batterybox, 60 1.4 Batterybox, 60 1.4 Batterybox, 60 0.6 Lampkit4 2.7 Box Assembly 60W - v2.0 2.5 Sonnection box 2.7 Box Assembly 60W - v2.0 2.1 Powerb, 60Ass 2.4 Batterybox, 60 2.1 Powerb, 60Ass 2.4 Batterybox, 60 1.1 Powerb, 60Ass 2.4 Batterybox, 100 1.6 Box Assembly 100W - v2.0 1.7 Powerb, 60Ass 2.7 Box Assembly 100W - v2.0 1.1 Powerb, 100Ass 2.5 Connection box 3.5 Gettery 100 Ass	AS018 AS019 AS009 AS008 FP003 AS009 FP003 AS009 AS010 AS001 AS009 AS001 AS008 AS008 AS008 AS008 AS008 AS009 AS009 AS009 AS009 AS008 AS008 AS009 AS008 AS008 AS009 AS00 AS00	GE026 BX005 FX001 FN011 FN012 GE013 FN012 GE013 FN012 GE002 GE012 IF003 BX003 FS010 GE007 GE007 IF035 FS010 GE007 IF035 FS010 GE007 IF035 FS010 GE007 IF035	box connector (for flat cable) Connection box Jomen Joern Nickelized bolt M3:20 Nickelized host M3:20 Nickelized nut M3 Single switch Nickelized nut M3 Lamp holder E27 Gjørette plug Terminal connector block 4:5 Sign installed by KW Battery box 60W back Faston wire end piper ed Circuit breaker IOA Gigarette plug Terminal connector block 4:5 Sign installed by KW Sattery box 60W back Faston wire end piper ed Circuit breaker IOA Gigarette plug Terminal connector block 4:5 Sign installed by KW Solar folder Solar folder Faston wire end piper ed Faston wire end piper ed Faston wire end piper ed Connection cable 2:x2.5mm2 Sim card	2 pcs 1 pcs 1 pcs 14 pcs 12 pcs 2 pcs 14 pcs 2 pcs 11 pcs 1 pcs	0,5 1,1,1 0,08 0,08 0,09 0,3 0,71 1,5 1,67 0,42 2,266 0,71 1,5 0,42 2,26 2,26 2,26 0,42 2,45 2,45 2,45 2,45 2,45 2,45 2,45 2	1 1,11 1,12 1,08 1,26 1,26 1,26 1,27 1,5 1,5 1,5 1,5 1,5 1,5 1,67 1,68 2,26 2,45 2,25 2,52 3,36 3,72 2,595	1 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0
1.3 Electronics, 100 Ass 1.7 Solar Assembly 100W 1.3 Electronics, 100 Ass 1.4 Electronics, 100 Ass 1.4 Batterybox, 100 1.5 Fastners, 100 Ass 1.4 Batterybox, 100 1.6 Box Assembly 100W - v.2.0 1.1 Powerb, 100Ass 1.4 Batterybox, 100 1.7 Solar Assembly 100W 1.7 Solar Assembly 100W 1.7 Folar Assembly 100W 1.1 Powerb, 100Ass 1.1 Powerb, 100Ass 1.1 Powerb, 100Ass 1.2 Powerb, 100Ass 1.2 Powerb, 100Ass 1.3 Fastners, 100 Ass 1.3 Fastners, 100 Ass 1.3 Fastners, 100 Ass 1.3 Fastners, 100 Ass	AS013 AS008 AS012 AS012 AS012 AS012 AS012 AS012 AS015 AS015 AS015 AS015 AS015 AS000 AS020 AS020 AS020 AS020 AS020 AS020 AS020 AS020 AS020 AS021 AS015	AS018 AS021 FN010 AS022 IF020 IF019 IF032 IF033 IF004 FN016 C8002 IF008 FS001 FN008 FN009 GE025 FS007 MC007 GE028	Resistor Display Ass FlatChale ass 60 FlatChale ass 60 FlatChale ass 60 Galvanized ring M4 Sim Ass Sticker 955.00 box serial Sticker 955.00 box serial Sticker 955.00 box serial stricker flage controlle Sticker electronic assembly Sticker 41 Ring M8 big Flat cable Warranty certificate Warranty certificate Galvanized not Galvanized both M4:20 Galvanized both M4:20 Galvanized both M4:20 Galvanized both M4:20 Galvanized mix M4 IEC female plug Microswith M4 IEC female plug Shirink tube 10mm² Shirink tube 10mm² Shirink tube 10mm² Serial plug Shirink tube 10mm² Serial plug Shirink bube 10mm² Serial plug Se	1 4 4 1 1 1 1 1 1 1 1 1 1 1 1 4 30 9 9 1 1 1 2 2 1 1 1 2 1 1 1 1 2 1 1 1 1	pcs	0,01 0 0,05 0,05 0,05 0,05 0,05 0,0175 0,0025 0,015 0,01 0,01 0,01 0,01 0,01 0,05 0,05	0 0,044 0,05 0,05 0,05 0,05 0,075 0,075 0,09 0,09 0,19 0,19 0,19 0,19 0,19 0,100 0,100 0,100 0,100 0,100 0,100 0,100 0,100 0,100 0,100 0,100 0,100 0,100 0,100 0,00 0 0,00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 0 0 1 1 0 0 1 0 0 1	2.2 FlotCable ass 60 2.2 FlotCable ass 60 2.4 Batterybox, 60 1.4 Batterybox, 60 1.4 Batterybox, 60 0.5 LampKit4 2.4 Batterybox, 60 0.5 LampKit4 2.7 Box Assembly 60W - v.2.0 2.5 Connection box 2.7 Box Assembly 60W - v.2.0 2.4 Batterybox, 60 2.1 Powerb, 60Ass 2.1 Powerb, 60Ass 1.1 Powerb, 60Ass 1.1 Batterybox, 60 1.1 Batterybox, 100W - v.2.0 1.1 Batterybox, 100 1.1 Batterybox, 100 1.1 Batterybox, 100 1.1 Batterybox, 100 1.2 Batterybox, 100 1.3 Batterybox, 100 2.5 Connection box 2.5 Connection box 2.5 Connection box 1.3 Electronics, 100 Ass	AS018 AS010 AS000 AS008 FP003 AS009 FP003 AS004 AS010 AS004 AS010 AS004 AS009 AS001 AS008 AS001 AS008 AS001 AS008 AS001 AS008 AS008 AS001 AS008 AS001 AS008 AS001 AS008 AS001 AS008 AS008 AS001 AS008	GE026 BX005 FN011 FN012 GE013 FN012 GE015 GE002 GE012 IF003 FS010 GE007 GE007 GE007 GE012 IF003 FS010 GE007	box connector (for flat cable) Connection box 10cms10cm Nickelized bott M3x20 Nickelized nut M3 Single switch Nickelized nut M3 Single switch Nickelized nut M3 Lamp holder E27 Gignette plug Terminal connector block 4 s Sign installed by W Battery box 60W back Faston wire end piper ed Circuit breaker 10A Gignette plug Terminal connector block 4 s Sign installed by KW Faston wire end piper ed Circuit breaker 10A Solar folder Circuit breaker 10A Solar folder Solar folder Faston wire end piper ed	2 pcs 1 pcs 11 pcs 12 pcs 2 pcs 14 pcs 4 pcs 2 pcs 11 pcs 1 pcs 2 pcs 1 pcs	0,5 1,1,1 0,08 0,08 0,09 0,3 0,71 1,5 1,5,7 0,42 2,26 0,71 1,5 0,42 2,26 2,26 2,26 0,42 2,26 2,245 2,25 2,2	1 1,12 1,08 1,2 1,26 1,15 1,5 1,5 1,5 1,5 1,5 1,5 1,5 1,5 1,	1 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0
1.3 Electronics, 100 Ass 1.7 Solar Assembly 100W 1.3 Electronics, 100 Ass 1.3 Electronics, 100 Ass 1.4 Batterphox, 100 1.5 Fashners, 100 Ass 1.4 Batterphox, 100 1.6 Box Assembly 100W 1.6 Pox Assembly 100W 1.4 Batterphox, 100 1.7 Solar Assembly 100W 1.7 Solar Assembly 10	AS013 AS008 AS012 AS012 AS012 AS012 AS012 AS012 AS013 AS013 AS015 AS017 AS001 AS008 AS008 AS008 AS002 AS020 AS020 AS020 AS021 AS015 AS015 AS015 AS015 AS017	AS018 AS021 FN010 AS022 IF020 IF019 IF032 IF033 IF004 FN016 CS02 IF008 FS001 FN008 FS001 FN009 GE006 GE025 FS007 MC007 GE028 MC002 GE028 FN021 GE028 FN021 GE028 FN021 GE028	Resistor Display Ass FlatChale ass 60 FlatChale ass 60 FlatChale ass 60 Galvanized ring M4 Sim Ass Sticker 9K5100 box serial Sticker 9K5100 box serial Sticker 9K5100 box serial Sticker 9K5100 box serial Sticker 144 Ring M8 big Flat cable Warranty certificate Warranty certificate Galvanized nut M4 IES Cemale plug Marker 145 Sticker 144 Six of the Sticker 145 Six of	1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 2	pes	0,01 0 0,05 0,15 0,05 0,05 0,05 0,05 0,0	0 0 0,04 0,05 0,05 0,05 0,05 0,05 0,07 0,075 0,08 0,09 0,19 0,11 0,11 0,005 0,005 0,005 0,19	0 1 0 0 1 1 0 0 1 0 0 1	2.2 FlotCable ass 60 2.2 FlotCable ass 60 2.4 Batterybox, 60 1.4 Batterybox, 60 1.6 LampKit4 2.4 Batterybox, 60 0.5 LampKit4 2.7 Box Assembly 60W - v.2.0 2.5 connection box 2.7 Box Assembly 60W - v.2.0 2.8 Batterybox, 60 2.1 Powerb, 60Ass 2.1 Box Assembly 100W - v.2.0 1.6 Box Assembly 100W - v.2.0 1.6 Box Assembly 100W - v.2.0 1.7 Box Assembly 10W - v.2.0 1.8 Box Assembly 10W - v.2.0 1.1 Powerb, 100Ass 2.5 connection box 2.5 connection box 1.3 Electronics, 100 Ass 1.3 Electronics, 100 Ass 1.4 Batterybox, 100 1.6 Box Assembly 60W - v.2.0 1.1 Flowerb, 10Ass	AS018 AS019 AS009 AS008 AS008 AS009 AS009 AS009 AS001 AS004 AS010 AS009 AS001 AS001 AS001 AS001 AS001 AS001 AS008 AS001 AS008	GE026 BX005 FN011 FN012 GE013 FN012 GE015 GE002 GE015 GE002 GE016 GE007 GE007 GE002 GE017 GE007 GE007 GE001 GE007 GE001 GE007 GE002 GE007 GE002 GE007 GE002 GE007 GE008 GE009	box connector (for flat cable) Connection box 10mm10cm Nickelized bott M3x20 Nickelized mtx M3 Single switch Nickelized mtx M3 Single switch Nickelized mtx M3 Lamp holder E27 Gegrette plug Terminal connector block 4 s Sign installed by M8 Battery box 60W back Faston wire end pipe red Grucult breaker 10A Gigerette plug Terminal connector block 4 s Sign installed by KW Faston wire end pipe red Grucult breaker 10A Solar folder Circuit breaker 10A Solar folder Faston wire end pipe red Faston wire end pipe red Grucult breaker 10A Solar folder Solar folder Faston wire end pipe red Faston wire end pipe red Faston wire end pipe red Solar folder	2 pcs 1 pcs 12 pcs 12 pcs 2 pcs 4 pcs 4 pcs 13 pcs 14 pcs 15 pcs 16 pcs 16 pcs 16 pcs 17 pcs 18 pcs 18 pcs 11 pcs 18 pcs 11 pcs	0,5 1,1,1 0,08 0,08 0,09 0,3 0,71 1,55 1,67 0,71 1,5 0,42 2,26 0,42 2,26 0,42 2,45 0,42 2,45 0,42 2,45 0,42 2,45 0,42 2,45 0,42 0,42 0,42 0,42 0,42 0,42 0,42 0,42	1 1,12 1,08 1,22 1,26 1,26 1,27 1,27 1,27 1,27 1,27 1,27 1,27 1,27	1 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0
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# C Calculation MFI payments

The average monthly payment for a large SHS with a 2-year loan (right bottom)

រីសិនហុវាន់ 2,00% តំលិរី SHS 100W 595 \$ បង់រំល**ោះ២ឆ**ុនាំ 24 (ខរំ)

	ប្ទាក់ដទើមនៅជំពាក់	ប្រាក់ដទើមត្លូវបង់	ការប <b>្</b> រាក់	ប្រាក់ស៊ាបដលែតៈរូវបង
ខទីែ1	595,00	24,79	11,90	36,69
ខទី2	570,21	24,79	11,40	36,20
ខទីែ3	545,42	24,79	10,91	35,70
ខទ្ទឹ4	520,63	24,79	10,41	35,20
ខទី5	495,83	24,79	9,92	34,71
ខទីៃ6	471,04	24,79	9,42	34,21
ខទីែ7	446,25	24,79	8,93	33,72
ខទ្វែន	421,46	24,79	8,43	33,22
ខទីែ9	396,67	24,79	7,93	32,73
ខទីែ10	371,88	24,79	7,44	32,23
ខទី11	347,08	24,79	6,94	31,73
ខទីវ12	322,29	24,79	6,45	31,24
ខទី13	297,50	24,79	5,95	30,74
ខទី14	272,71	24,79	5,45	30,25
ខទី15	247,92	24,79	4,96	29,75
ខទី16	223,13	24,79	4,46	29,25
ខទី17	198,33	24,79	3,97	28,76
ខទី18	173,54	24,79	3,47	28,26
ខទី19	148,75	24,79	2,98	27,77
ខទី20	123,96	24,79	2,48	27,27
ខទី21	99,17	24,79	1,98	26,78
ខទី22	74,38	24,79	1,49	26,28
ខទី23	49,58	24,79	0,99	25,78
ខទ្វី24	24,79	24,79	0,50	25,29
	ស៊ុប	595	148,75	743,75

30,99

The average monthly payment for a regular SHS with a 2-year loan (right bottom)

រីសិនហ្សាន់ 2,00% តំលះ SHS 60W 450 \$ បងរំល**ោះ២ឆ**ុនាំ 24 (ខរំ)

	ប្ទាក់ដទើមនៅជំពាក់	ប <b>្</b> រាក់ដ <b>ើ</b> មត <b>្</b> រូវបង់	ការប្្វាក់	បណ្ដាក់សរុបដលែតៈរូវបង់
ខទី1	450,00	18,75	9,00	27,75
ខទីែ2	431,25	18,75	8,63	27,38
ខទែី3	412,50	18,75	8,25	27,00
ខទឹំ4	393,75	18,75	7,88	26,63
ខទៃី5	375,00	18,75	7,50	26,25
ខទីៃ6	356,25	18,75	7,13	25,88
ខទីែ7	337,50	18,75	6,75	25,50
ខទីែ8	318,75	18,75	6,38	25,13
ខទី១	300,00	18,75	6,00	24,75
ខទីែ10	281,25	18,75	5,63	24,38
ខទី11	262,50	18,75	5,25	24,00
ខទីែ12	243,75	18,75	4,88	23,63
ខទី13	225,00	18,75	4,50	23,25
ខទីវ	206,25	18,75	4,13	22,88
ខទីែ15	187,50	18,75	3,75	22,50
ខទី16	168,75	18,75	3,38	22,13
ខទី17	150,00	18,75	3,00	21,75
ខទីែ18	131,25	18,75	2,63	21,38
ខទី19	112,50	18,75	2,25	21,00
ខទី20	93,75	18,75	1,88	20,63
ខទី21	75,00	18,75	1,50	20,25
ខទី22	56,25	18,75	1,13	19,88
ខទី23	37,50	18,75	0,75	19,50
ខទ្វី24	18,75	18,75	0,38	19,13
	សាប	450	112,50	562,50

23,44

# D Calculation solar panel position

Month	Sun angle <sup>1</sup> :	Hours sun/day <sup>2</sup> :	Consistency factor:
January	62° (61-63)	4,99	1,004
February	70° (69-71)	5,48	0,914
March	78° (77-79)	5,77	0,868
April	86° (85-87)	5,84	0,858
May	94° (93-95)	5,31	0,944
June	101° (100-102)	4,93	1,016
July	94° (93-95)	4,81	1,042
August	86° (85-87)	4,61	1,087
September	78° (77-79)	4,60	1,089
October	70° (69-71)	4,53	1,106
November	62° (61-63)	4,58	1,094
December	55° (54-56)	4,56	1,099
Average:	78°	5,01	-
Total:	-	60.01	12,121

## Average sun angle

 $\rightarrow$  SUM([Sun angle]) / 12 = 936 / 12 = 78°

## Annual consistent power production

- > SUM([Sun angle] x [consistency factor]) / 12,121 =
- (62,248+63,98+67,704+73,788+88,735+102,616+97,948+93,482+84,942+77,42+67,828+60,445) / 12,121 =
- 941,136 / 12,121 = 77,6450788
- $\rightarrow$  Angle = 90 77,65 = 12,35 °

## Maximal yearly power production

- > SUM([Sun angle] x [optimal annual output factor]) / [Total optimal annual output factor] = 78,35°
- Angle solar panel: 90 78,35 = 11,65°

## Consistency factor

> [Average Hours sun/day] / [Hours sun/day] = 5,01 / [Hours sun/day]

## Optimal annual output factor

> [Hours sun/day] / [Average Hours sun/day] = [Hours sun/day] / 5,01

## Goal of the research

To verify the focus topic that is most depending to the customer's understanding–Expandability–, a research was conducted. For this research three main goals were determined:

- Do customers understand the concept of expanding a SHS?
- > Is there a demand for an expandable SHS?
- Are multiple system sizes desired?

Since this research was performed with T. Den Heeten, at that time performing research in the same topic with a different focus, several additional questions emerged. For the clarity of this part of the research they are not included here. Before the execution of the research, a booklet and game were designed. A pilot was performed with an employee of Kamworks.

## Method

Seven participants were involved in the research. They are persons/households who already own a SHS. They were located in several villages in the Kampong Chhnang province. They were asked to fill in a booklet and to play a game. A translator speaking both English and Khmer joined the three-day trip to translate everything.

The booklet with questions regarding their current situation was filled in partially before and partially after the game. This booklet gave insights in the households' current situations. The game represents a simplified version of the potential future portfolio of Kamworks. The gameplay and questionnaire helped to gain insight in the understanding of, and attitude towards, expandability of different system sizes.

The research was observed and captured through voice recording, notes and pictures. In the end the results were discussed and linked to the participant's real situation.

## Results

The progress of the game is shown on page 12 and 13. It gives insight in the participants' attitudes towards dealing with money. Some results are more relevant to the research goals than others.

- > Participants understood the concept of expanding a system.
- All participants were more confident in their actions in the second round (e.g. a participant mentioned she wanted to save money for three months to buy a certain appliance).
- Two (out of 7) participants needed to expand their large SHS in the second round. These were village

chief with an income higher than other participants.

- Six out of seven participants would prefer buying a big system in the first place.
- Grid is expanding, but participants still have a positive attitude towards solar energy as addition to reduce the grid costs.
- Three participants complained that they wanted to expand their system already, but do not know how. They were owners of a large SHS.
- > All customers experienced a lack of after sales & service.

## Discussion

The game was not only useful for the research, but also for the participants. Some indicated they liked the game because it is a fun way to learn how to manage income. In general there is little knowledge about the income of a household. During the game, the two village chiefs bought more appliances. This is possibly related to their actual income: their attitude towards buying products / saving money may be different than the other participants with an actual lower income.

Two participants had access to both a SHS and the grid. One of them mentioned he used the SHS for light and charging phone, while he used the grid as less as possible due to the (high) costs. Grid is a competitor, but it can also stimulate selling smaller systems if it is sold as a solution to reduce grid costs.

When participants were asked what system they would buy first, they mentioned it depended mostly on the price. However, looking at Kamworks experiences, customers would most of the times go for an as large system as possible. One participant mentioning she would buy a small system first was because she wanted to test the new technology first before investing. Also the way participants would expand 'their' systems differed: some would expand with the same system size, others would like to expand with a smaller system. This implies that multiple system sizes are desired and the system sizes should be combinable. Moreover, giving the user the choice of multiple products may stimulate sales.

In the last place the complaints regarding after sales and services should be a thing for Kamworks to keep in mind. In the first place, keeping in touch with the customers could stimulate the demand for accessories, if they would offer them. Currently this is not the case. Offering the right appliances could reduce the misuse of the SHS by unsuitable appliances, but more importantly it may indirectly

## Expandable Solar Home System Game

The materials of the game can be divided in four groups: The playing board, Solar Home Systems, Appliances and Money. Additionaly there are 'future objects' like a scooter or a car (that cannot be bought) to give the player the choise between investing directly or saving for the future. An overview of prices for the Solar Home Systems and appliances is provided.

- > The playground The playing board shows 12 steps. Each step represents a month. Every turn the player can buy a SHS, Appliances, or save money.
- > Solar Home Systems Three sizes are available: small, normal and large. A SHS is payed through a monthly fee of respectively \$20, \$30 or \$50. These fees represent the monthly fees for a loan. The sizes differ in the amount of boxes, representing the capacity.
- Appliances There are several appliances (TV, iron, rice cooker, electric kettle, etcetera) available that can be purchased. The size of the card stands for the power consumption for 4 hours. If a player indicates he/she uses an appliance for longer than 4 hours, additional space is taken from the SHS boxes.
- Money A player recieves \$100 in fake dollar bills each turn. They can be spent on expanding their SHS capacity or buy additional appliances. It is also possible to safe money.

One player (1 person or 1 household) plays the game 2 rounds: one starting with a small SHS and one starting with the large SHS. In addition to that a player recieves 50\$, 4 lights and a phone.

There is no winning or losing in the game, it is only about learning how the players would deal with their money in real life.

## Rules:

- > Each turn the player recieves 100\$ and has the possibility of buying a SHS or appliances.
- > Purchased appliances need to stay on the SHS card(s).
- > You cannot have more appliances (in size) than the boxes of the owned SHS provide. In that case an additional SHS should be bought first.
- After each round the game will be evaluated, the amount of SHS, appliances and money possesed by the player will be noted. A round will be concluded with a questionnaire about the progress of the game (How did it go? What did you like/dislike? etc.)









stimulate the expansion of a SHS.

## Conclusions

After the conducted research it can be concluded that customers do understand the concept of expanding. In fact some participants mentioned this demand themselves. It makes more sense to them that it is possible than explaining the system is fixed. Most of T. Den Heeten's research goals were related to the use of appliances. It turns out that people will buy 'luxury' products like a TV, iron or electric kettle as soon as they can afford it. With this attitude in a growing economy, the demand for an expandable SHS will be definitely there.

Siebinga's design proposal offers a single sized, expandable SHS. However, participants indicated they would expand their SHS in different ways. Offering two system sizes that are expandable and

interchangeable should suit the market's demand.

## Additional note

In addition to the conclusions relevant for this project, an issue occurred that may be good to know for future research. Participating in the game was initially perceived tricky to some participants. Apparently there are salesmen trying to 'play a game' with these people and then force them to buy things. After explaining clearly we were students doing research only made them feel comfortable with it.



## Expandable Solar Home System Game

After the game questions were asked. The questions mentioned below were meant as a guideline.

- What did you think of the game?
- > What did you like/dislike?
- Did you find things hard to understand during the game?
- Which round did you liked the most? [ask while showing the results]
- > Imagine you were a new customer: which system would you buy? Why?
- Are you aware that the total investment is lower when you buy a big system in the first place?
- Would you prefer a small system that you can expand or a big system? Why?



# **Results SHS game**

User	Appliances round 1	Amo	Amount of appliances	Appliances round 2	2.5	Amount of appliances
-	Radio, ricecooker, TV, Water kettle, 2nd fan		5	Radio, water kettl	Radio, water kettle, rice cooker, TV.	4
2 TV, ri	TV, ricecooker, iron, radio, water kettle.		9	Fridge		
3 TV, ft	3 TV, fan, ricecooker, iron, radio, kettle		9	TV, radio, fan, rio	TV, radio, fan, ricecooker, iron, water kettle, fridge	7
4 Fan,	4 Fan, radio, ricecooker, fridge, washing machine	machine , TV.	9	TV, radio, washin		4
5 Ricec	5 Ricecooker. TV, Radio, Iron		4	TV, water kettle, <b>fridge</b> , radio	<b>fridge</b> , radio.	4
9 T≺, II	6 TV, Iron, Fan		3	Lamp, Fan, TV, V	Lamp, Fan, TV, Water kettle, Radio, Speaker	9
7 TV, F	7 TV, Radio, Ricecooker, kettle		4	Ricecooker, TV, r	Ricecooker, TV, radio, water kettle, stereo set, iron, fridge	
Round 1 Small System			Round 2 Big System			
Step	Bought	Comments	Step	Purchases	Comments	
	1 Wants to save for a TV 2 Buys a Radio				Wants to earn money, than buy appliances	
	4 Wante a rice confer and a D/					T
	5 Buys a 2nd SHS and a ricecooker			Thinks about buying a fridge. Doesn't do it. Buys a water kettle	s a water kettle Fridge takes a lot of energy. Does she understands?	¿spı
	- 2			7 Buys a TV (5-8 hours)	Tes she understands, but then she doesn't wan	=
	8 Buys a TV (8 hours)	Starts counting the steps till the end	P			
	10-			10-		
	11 Buys a 3rd SHS and a water kettle			-		
	12 Wants an Iron. This doesn't fit. Buys a 2nd fan.			- 21		
Total With the money leftover I would hiv:	420\$ Kobuta Wants a hoat ako but can't afford it		Total With the money leftover I would hiv:	400\$ She wants to have a house as she has now hut then with chosed wills	Ithen with closed walk	
	П			П		
Appliances	Radio, ricecooker, TV, Water kettle, 2nd fan			Radio, water kettle, rice cooker, TV.		
Round 1 Small System		Round 2 Big System	-			
Step	Bought Comments	Step	Purchases Comments			
	2 Wante to hive a TV hist sha can't afford it vat		1 Wants to buy a fridge.			
	3 Buys TV and a 2nd SHS.		4 m			
	4 Buys ricecooker.					
	5 Buys iron and 3rd Daughter takes over. 6 Wants a fridge? Maybe at the end of the game.		5 save money first 6 save money first			
			7 -			
	o e e e e e e e e e e e e e e e e e e e					
	10		10 -			
	11 Kettle + 4th system.		-11			
	12		- 21 -			
Total With the money leftover. I would buy:	310\$	Total With the money leftover. I would buy:	400\$ Would like to have a car.			
			П			
Appliances	TV, ricecooker, iron, radio, water kettle.	Appliances	Fridge			
Round 1 Small System	П		Round 2 Big System	П		
Step	Bought Comments		Step	Purchases Comments		
	2 She wants a TV, but can't afford it yet			- 2		
	3 TV (4hours)			3 Buys TV.		
	4 Buys a ran and 2nd 5h5			5 Buys Radio.		
	6 Buys a ricecooker. Understands it costs a lot of energy	ergy.				
	7 Wants an iron, but doesn't buy it because she would need an extra system	Id need an extra system (=expensive)		7 Buys Iron.		
	9 Buvs iron + 3rd SHS				e left.	
	10 Wants a fridge, but this does not fit.					
	11 Buys radio. Wants a water kettle, because she does not have to pay for the	is not have to pay for the 4th system.		11 Buys SHS to power the fridge.		
	12 Buys kette & 4th system.			71		
Total	370\$		Total	20\$		
Appliances	TV, fan, ricecooker, iron, radio, kettle		Appliances	TV, radio, fan, ricecooker, iron, water kettle, fridge	©.	

Participant 1

Participant 2

Participant 3

Round I Siliali System							
Step	Bought Comments	Step			Comments		
	2 Wants to buy a lapton. Buys fan		- 8	Saves for TV			
	3 Radio To listen to the news		1 6	Buys TV.			
	4 Wants a washing machine. Buys ricecooker and 2nd SHS.	iker and 2nd SHS.	4 4	Buys Radio			
	6 Buys a washing m Pays 150\$ for washin	ig machine					
	7 Wants a PC for his kids. 8 TV + 4th SHS. Bu System full			Buys Washing machine			
	10		9 01				
	12		11 11	Buys Fridge + 130Wp system	ystem		
101	9000	T-					
With the money leftover, I would buy:		With the mone	With the money leftover, I would buy:				
Appliances	Fan, radio, ricecooker, fridge, washing machine, TV.	nachine, TV. Appliances		TV, radio, washing machine, fridge	hine, fridge.		
Dound 1 Small Suetam			Dough 2 Bir Svetem				
Step	Bought Comments		Step		Purchases Comments		
	1 Wants ricecooker. Saves money				Wants to save for a fridge.		
	2 wants DVD player. Declares to save mon 3 Buys TV.	пеу		3 2			
		ooker, because she has an alternal	ıtive.	4 6	uys TV.		
				100	Buys Kettle. We tell her the fric	We tell her the fridge does not fit anymore. Is okay with her.	
	o wants to have a phone. Wants to have an iron. buys an iron.  7 Is willing to pay 100\$ for SHS pump.	an iron. Buys an iron.		20 1	till wants a mage		
				80			
	- 00 00			0 0	Buys Fridge and 7 Not sure if this is correctly noted down	prectly noted down.	
	11.			2 11	each).		
	12 -			12	Wants fridge. Nee	Wants fridge. Needs another system.	
Total	300\$		Total				
With the money leftover, I would buy:			With the money leftover, I would buy:	iver, I would buy:			
Appliances	Ricecooker. TV, Radio, Iron		Appliances		TV, water kettle, fridge, radio.		
Round 1 Small System		Round 2 Big Syst	tem				
de	Bought Comments	Step	-	Purchases Comments	nts		
	Wants to have a ricecooker. Decides to save money	save money	2 Buy	Buys lamps & sec Second fan for guests	fan for guests.		
	4 Buys iron and 2nd Iron for special events only.	s only.	5 We	vs TV	niey		
			5 Bu	5 Buys Water kettle & radio			
	vants to have ind one wants to have a mage to cool of	indge to cool 10	7	ants speaker. Discou	Discount to 1003		
			80 0				
	- 01		9 6				
	11 -		1 2				
Tabe	e c	1					
With the money leftover, I would buy:	A kobuta for her farm. She can earn more money than.	With the money I	eftover, I would buy:				
Appliances	TV, Iron, Fan	Appliances	Lar	Lamp, Fan, TV, Water kettle, Radio, Speaker	le, Radio, Speaker		
Round 1 Small System		Round 2 Big Syst	me				
dep	Bought Comments	Step		urchases Comments	ents		
	PRefers to save. V		- 0	Save for TV			
	3 TV (5 hours). Has to buy a second SHS.			Buys ricecooker			
	4 Radio			Buys TV, buys radio.			
			S S	Buys water kettle.			
	I Doesn't want more After suggestive question by translat	stion by translate	7 Wa	ants solar pump To wat	will do karaoke.     roops and plants. She would get	if she could get a loan for this.	
			8 Bu	uys iron. 20 ye	Buys iron. 20 years loan, low interest rate, 2000\$		
	10 -		9 Wa	Wants fridge			
			11 Bu	Buys fridge.			
	- 71		21				
Total							
With the money leftoyer I would him		With the money le	leftower I would him:				

Participant 4 Participant 5 Participant 6 Participant 7



Adress: Sré Ampil village Kien Svay district Kandal province

Mailing adress: PO Box 2497 Phnom Penh

Cambodia

T +855 (0)92 962 162 T +855 (0)23 351 454 I www.kamworks.com E info@kamworks.com

298 mm

## **Solar Home Box**

## **Specification**

Compatible with RA12-33, RA12-40, and RA12-55 batteries

Weight: 1088 grams

Dimensions: 354mm x 247mm x 298mm

Material: Recycled ABS

Compatible with Phocos CML and CA series

charge controllers

Stackable for ease of transport

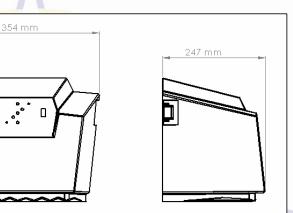
Non-reversible ports for power IN and OUT

Integrated over-current circuit breaker port

Strong flex resistant base

Small form factor

Power display easily visible when box is placed on floor











Adress:

Sré Ampil village Kien Svay district Kandal province Cambodia

Mailing address: PO Box 2497 Phnom Penh

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## **Solar Home Box 100**

## **Specification**

Compatible with RA12-100 batteries

Weight: 3000 grams

Dimensions: 495mm x 365mm x 270mm

Material: fiberglass

Compatible with Phocos CML and CA series charge controllers and SNRE SR-MT2410

charge controllers

Stackable for ease of transport

Small form factor

Power display easily visible when box is placed on floor





Sustainable solar solutions for off-grid communities



## **RA12-55**

## (12V55Ah)

RA series is a general purpose battery with 10 years design life in float service. It meets with IEC, JIS and BS standards .With up-dated AGM valve regulated technology and high purity raw materials, the RA series battery maintains high consistency for better performance and reliable standby service life. It is suitable for UPS/EPS, medical equipment, emergency light and security system applications.

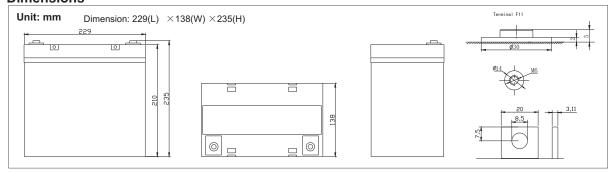


## **Specification**

Specification	
Cells Per Unit	6
Voltage Per Unit	12
Capacity	55Ah@10hr-rate to 1.80V per cell @25°C
Weight	Approx. 18.0 Kg ( Tolerance $\pm 3\%$ )
Max. Discharge Current	550A (5 sec)
Internal Resistance	Approx. 6 m $\Omega$
Operating Temperature Range	Discharge: -20°C~60°C Charge: 0°C~50°C Storage: -20°C~60°C
Normal Operating Temperature Range	25℃±5℃
Float charging Voltage	13.6 to 13.8 VDC/unit Average at 25°C
Recommended Maximum Charging Current	16.5 A
Equalization and Cycle Service	14.6 to 14.8 VDC/unit Average at 25°C
Self Discharge	RITAR Valve Regulated Lead Acid (VRLA) batteries can be stored for more than 6 months at 25°C. Self-discharge ratio less than 3% per month at 25°C. Please charge batteries before using.
Terminal	Terminal F11/F15
Container Material	A.B.S. UL94-HB, UL94-V0 Optional.

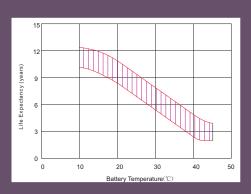


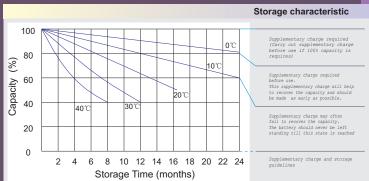
## **Dimensions**

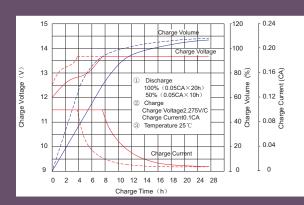


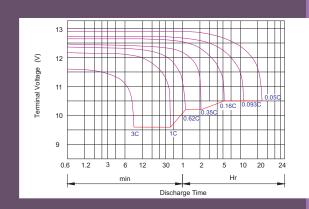
#### Constant Current Discharge Characteristics: A (25°C) F.V/Time 5MIN 10MIN 15MIN 30MIN 1HR 2HR 3HR 4HR 5HR 8HR 10HR 20HR 9.60V 192.6 141.8 105.8 55.26 34.33 21.20 14.40 11.61 9.64 6.35 5.72 3.03 10.0V 187.0 134.9 103.6 54.55 33.87 20.77 14.14 11.45 9.56 6.33 5.67 2.97 101.97 10.2V 181.5 130.1 53.72 33.55 20.55 14.01 11.34 9.49 6.27 5.61 2.92 120.1 97.09 10.5V 162.9 52.24 33.14 20.28 13.89 11.17 9.41 6.21 5.56 2.86 147.1 109.5 89.50 50.51 10.8V 32.68 20.11 13.73 10.79 9.37 6.19 5.50 2.83 125.6 97.9 80.28 48.59 11.1V 31.90 19.30 13.46 10.63 9.30 6.14 5.44 2.72

(	Constant Power Discharge Characteristics: W(25°C)												
	F.V/Time	5MIN	10MIN	15MIN	30MIN	1HR	2HR	3HR	4HR	5HR	8HR	10HR	20HR
	9.60V	2032	1510	1153	632.6	397.8	248.4	169.6	139.0	115.5	76.04	68.63	36.50
	10.0V	1992	1464	1135	626.0	394.2	245.3	167.1	137.1	114.5	75.75	68.09	35.86
	10.2V	1969	1425	1122	620.6	391.9	243.6	166.3	135.8	113.8	75.18	67.49	35.20
	10.5V	1792	1327	1070	607.9	389.4	240.5	165.0	133.9	112.9	74.54	66.82	34.54
	10.8V	1633	1223	989.0	593.5	384.4	238.7	163.1	129.4	112.3	74.22	66.16	34.20
	11.1V	1434	1106	890.3	577.2	378.6	229.8	160.4	127.6	111.9	73.70	65.44	32.98









## **Capacity Factors With Different Temperature**

Battery	Туре	-20℃	-10°C	0℃	5℃	10℃	20℃	25℃	30℃	40℃	45℃
GEL	6V&12V	50%	70%	83%	85%	90%	98%	100%	102%	104%	105%
Battery	2V	60%	75%	85%	88%	92%	99%	100%	103%	105%	106%
AGM	6V&12V	46%	66%	76%	83%	90%	98%	100%	103%	107%	109%
Battery	2V	55%	70%	80%	85%	92%	99%	100%	104%	108%	110%

## Discharge Current VS. Discharge Voltage

Final Discharge Voltage V/cell	1.75V	1.70V	1.60V		
Discharge	(A) ≤0.2C	0.2C< (A) <1.0C	(A) ≥1.0C		

# Charge the batteries at least once every six months, if they are stored at 25 $^{\circ}\text{C}.$

## Charging Method:

Constant Voltage	-0.2Cx2h+14.4-14.7Vx24h,Max. Current 0.3C
Constant Current	-0.2Cx2h+0.1Cx12h
Fast	-0.2Cx2h+0.3Cx4h

Bolt	M5	M6	M8
Terminal	F3 F4 F13 F18 T25 T26	F8 F11 F12-1 F15	F5 F9 F10 F12 F14 F16
Torque	6~7N-m	8~10N-m	10~12N-m

## **Maintenance & Cautions**

Float Service:	
Every month, recommend inspection every battery voltage.	
Every three months, recommend equalization charge for one time.	
Equalization charge method:	
Discharge: 100% rate capacity discharge.	
Charge: Max. current 0.3CA, constant voltage 14.4-14.7V charge 24h.	
Effect of temperature on float charge voltage: -3mV/C/Cell.	
Length of service life will be directly affected by the number of discharged the service life will be directly affected by the number of discharged the service life will be directly affected by the number of discharged the service life will be directly affected by the number of discharged the service life will be directly affected by the number of discharged the service life will be directly affected by the number of discharged the service life will be directly affected by the number of discharged the service life will be directly affected by the number of discharged the service life will be directly affected by the number of discharged the service life will be directly affected by the number of discharged the service life will be directly affected by the number of discharged the service life will be directly affected by the number of discharged the service life will be directly affected by the service life will be directly affected by the number of discharged the service life will be directly affected by the service life will be directly after the service life will be discharged the service life will be directly after the service life will be	ge
cycles, depth of discharge, ambient temperature and charging voltage.	
Liuchan Building Langeban Bd46 Nanahan District Chan7han E40057 China	

SHENZHEN RITAR POWER CO.,LTD.

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# **RA12-100**

# (12V100Ah)

RA series is a general purpose battery with 10 years design life in float service. It meets with IEC, JIS and BS standards .With up-dated AGM valve regulated technology and high purity raw materials, the RA series battery maintains high consistency for better performance and reliable standby service life. It is suitable for UPS/EPS, medical equipment, emergency light and security system applications.

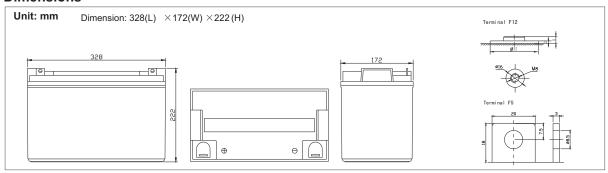


## **Specification**

<u> </u>	
Cells Per Unit	6
Voltage Per Unit	12
Capacity	100Ah@10hr-rate to 1.80V per cell @25°C
Weight	Approx.30.0 Kg( Tolerance $\pm 2\%$ )
Max. Discharge Current	1000A (5 sec)
Internal Resistance	Approx. $5m \Omega$
Operating Temperature Range	Discharge: -20°C ~60°C Charge: 0°C~50°C Storage: -20°C~60°C
Normal Operating Temperature Range	25°C±5°C
Float charging Voltage	13.6 to 13.8 VDC/unit Average at 25°C
Recommended Maximum Charging Current Limit	30 A
Equalization and Cycle Service	14.6 to 14.8 VDC/unit Average at 25°C
Self Discharge	RITAR Valve Regulated Lead Acid (VRLA) batteries can be stored for more than 6 months at 25°C. Self-discharge ratio less than 3% per month at 25°C. Please charge batteries before using.
Terminal	Terminal F5/F12
Container Material	A.B.S. UL94-HB, UL94-V0 Optional.



## **Dimensions**



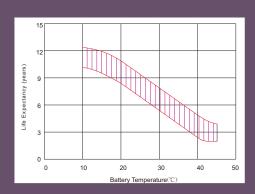
## Constant Current Discharge Characteristics: A (25°C)

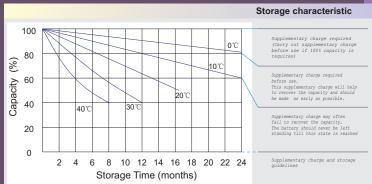
F.V/Time	5MIN	10MIN	15MIN	30MIN	1HR	2HR	3HR	4HR	5HR	8HR	10HR	20HR
9.60V	320.7	226.9	181.4	112.7	65.00	38.89	26.88	22.03	18.03	12.42	10.50	5.78
10.0V	311.4	215.8	177.7	110.8	64.70	38.60	26.78	21.93	17.93	12.32	10.40	5.67
10.2V	302.2	208.2	174.9	109.8	64.10	38.31	26.57	21.83	17.82	12.22	10.30	5.57
10.5V	271.3	192.1	166.5	107.1	63.50	38.02	26.47	21.62	17.61	12.12	10.20	5.46
10.8V	244.9	175.2	153.5	102.4	62.00	37.33	25.75	21.11	17.29	11.92	10.10	5.36
11.1V	209.1	156.6	137.7	95.91	58.90	35.68	24.62	20.09	16.55	11.41	9.80	5.04

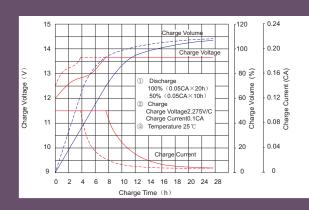
## Constant Power Discharge Characteristics: W(25°C)

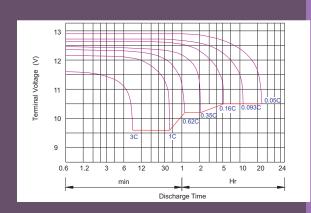
F.V/Time	5MIN	10MIN	15MIN	30MIN	1HR	2HR	3HR	4HR	5HR	8HR	10HR	20HR
9.60V	3317	2416	1996	1284	751.1	458.4	319.9	262.6	215.1	148.3	125.5	69.26
10.0V	3251	2342	1964	1269	749.3	456.0	320.0	262.3	214.6	147.6	124.7	68.06
10.2V	3214	2280	1941	1260	743.5	453.3	318.6	261.7	213.9	146.6	123.6	66.80
10.5V	2926	2123	1852	1230	736.8	450.0	317.4	259.3	211.3	145.4	122.4	65.54
10.8V	2665	1957	1712	1179	723.2	444.2	308.7	253.4	207.5	143.0	121.2	64.28
11.1V	2341	1770	1541	1108	692.3	427.7	295.4	241.1	198.6	136.9	117.6	60.50

All mentioned values are average values (Tolerance  $\pm 2\%$ ).









## **Capacity Factors With Different Temperature**

Battery	Туре	-20℃	-10°C	0℃	5℃	10℃	20℃	25℃	30℃	40℃	45℃
GEL	6V&12V	50%	70%	83%	85%	90%	98%	100%	102%	104%	105%
Battery	2V	60%	75%	85%	88%	92%	99%	100%	103%	105%	106%
AGM	6V&12V	46%	66%	76%	83%	90%	98%	100%	103%	107%	109%
Battery	2V	55%	70%	80%	85%	92%	99%	100%	104%	108%	110%

## Discharge Current VS. Discharge Voltage

Final Discharge Voltage V/cell	1.75V	1.70V	1.60V		
Discharge Current (A)	(A) ≤0.2C	0.2C< (A) <1.0C	(A) ≥1.0C		

# Charge the batteries at least once every six months, if they are stored at 25 $^{\circ}\text{C}.$

#### Charging Method:

Constant Voltage	-0.2Cx2h+14.4-14.7Vx24h,Max. Current 0.3C
Constant Current	-0.2Cx2h+0.1Cx12h
Fast	-0.2Cx2h+0.3Cx4h

Bolt	Bolt M5		M8		
<b>Terminal</b> F3 F4 F13 F18 T25 T26		F8 F11 F12-1 F15	F5 F9 F10 F12 F14 F16		
Torque 6~7N-m		8~10N-m	10~12N-m		

#### **Maintenance & Cautions**

Float Service:

Every month, recommend inspection every battery voltage.

Every three months, recommend equalization charge for one time.

Equalization charge method:

Discharge: 100% rate capacity discharge.

Charge: Max. current 0.3CA, constant voltage 14.4-14.7V charge 24h.

Charge. Max. current 0.50A, constant voltage 14.4-14.7 v charge 241

Effect of temperature on float charge voltage: -3mV/C/Cell.

Length of service life will be directly affected by the number of discharge cycles, depth of discharge, ambient temperature and charging voltage.

SHENZHEN RITAR POWER CO.,LTD.

URL:www.ritarpower.con

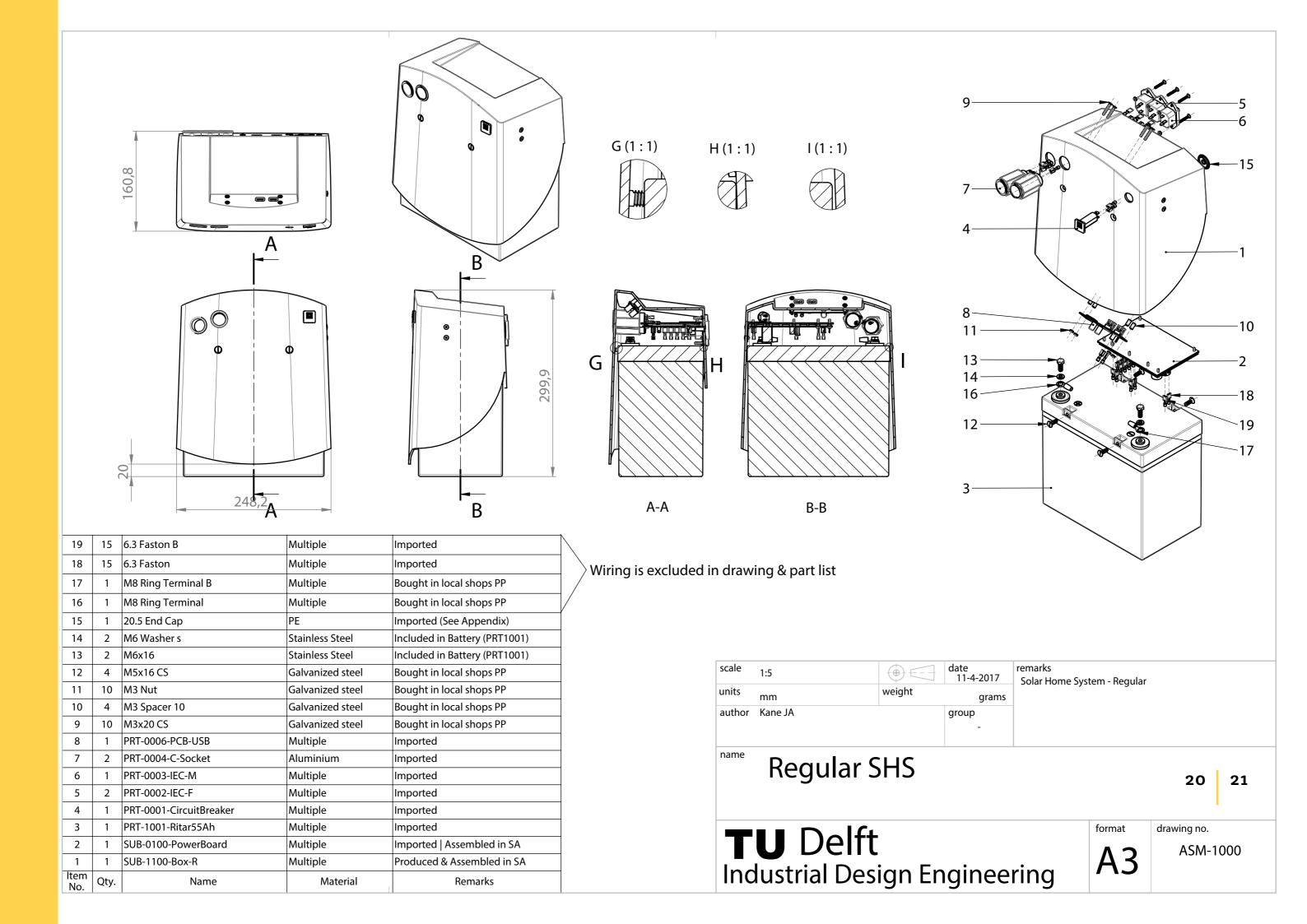
Address: Rm405,Tower C, Huahan Building,Langshan Rd16, Nanshan District, ShenZhen, 518057, Chi Tel:+86-755-33981668 Fax:86-755-8347-5180

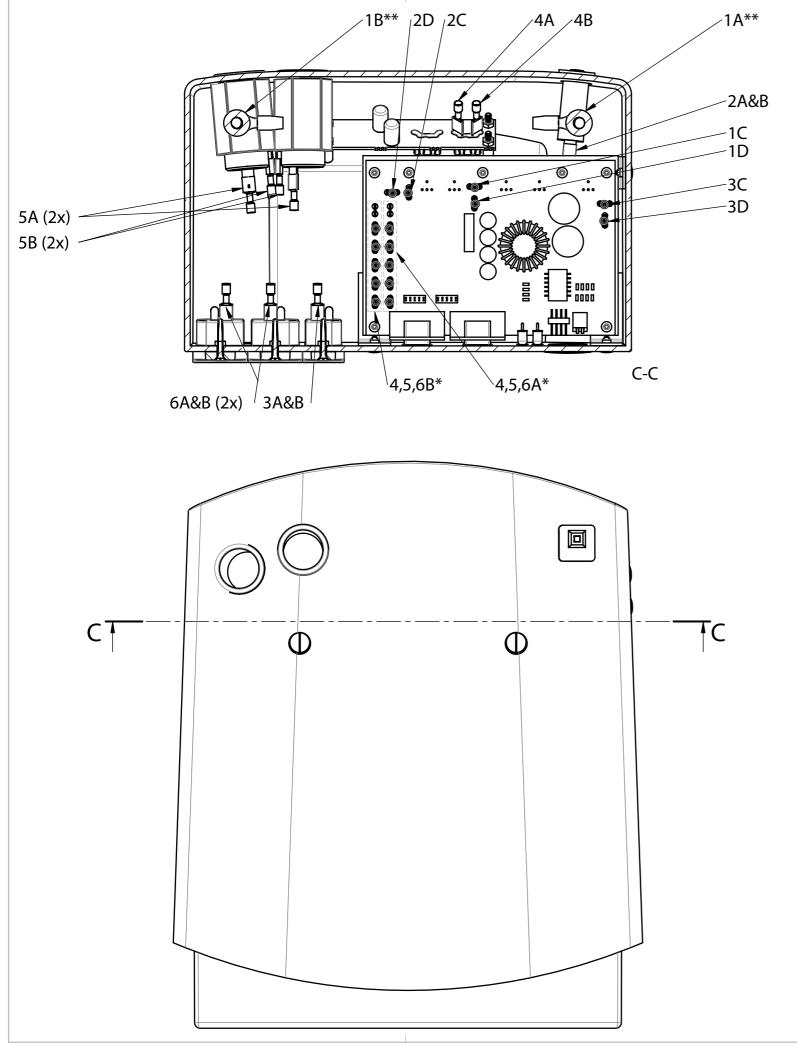
# H Technical drawings Battery Box

In this section the technical drawings of the assembled battery boxes and its parts are provided. An overview of the parts can be found, which is used for the cost estimation of the redesign (appendix L).

The technical drawings are divided in three parts, indicated with a yellow bar (see the right page). The first part is the regular battery box and the parts that are only used for this system size. The second part is the same, but for the large battery box. The last parts are some parts that are used in both battery boxes.

Standard parts (sockets, screws, etcetera) are only included in the CAD model. They cannot be found in these drawings.





## **Electronics:**

- 1 = Battery
- 2 = Circuit Breaker
- 3 = Solar Panel
- 4 = USB
- 5 = Cigarette sockets
- 6 = Lampkit/Expansion Battery

Connect all components (A&B) topowerboard (C&D)

- \* Make horizontal pairs. Sequence 4,5 and 6 is irrelevant
- \*\* Connected to the battery



Regular SHS

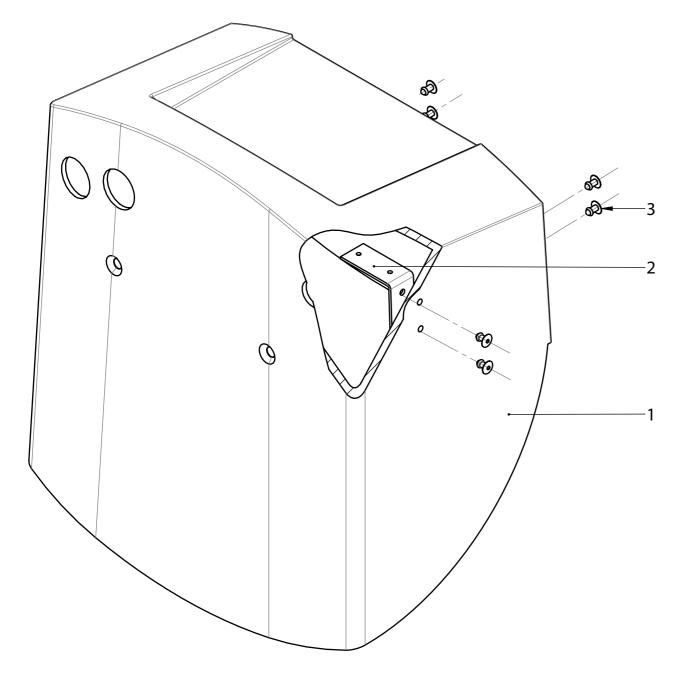
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format

**A3** 

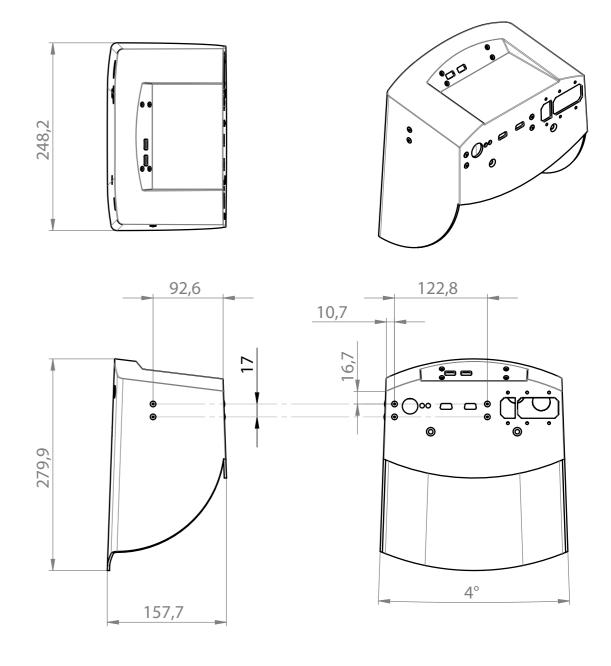
drawing no.

ASM-1000



Scale 1:2

3	3 6 3,2x8 Blind Rivet		Aluminium	Bough in local shops PP	
2	2 3 PRT-0005-BracketPCB		Galvanized steel	Raw material PP - Produced in SA	
1	1 1 PRT-1101-Box-R		Glassfiber	Raw material PP - Produced in SA	
Item No.	Qty.	Name	Material	Remarks / Drawing. No.	



scale units	weight		date 11-4-2017 grams	remarks Solar Home Systen - Regular
author	Kane J A		group -	

Regular SHS

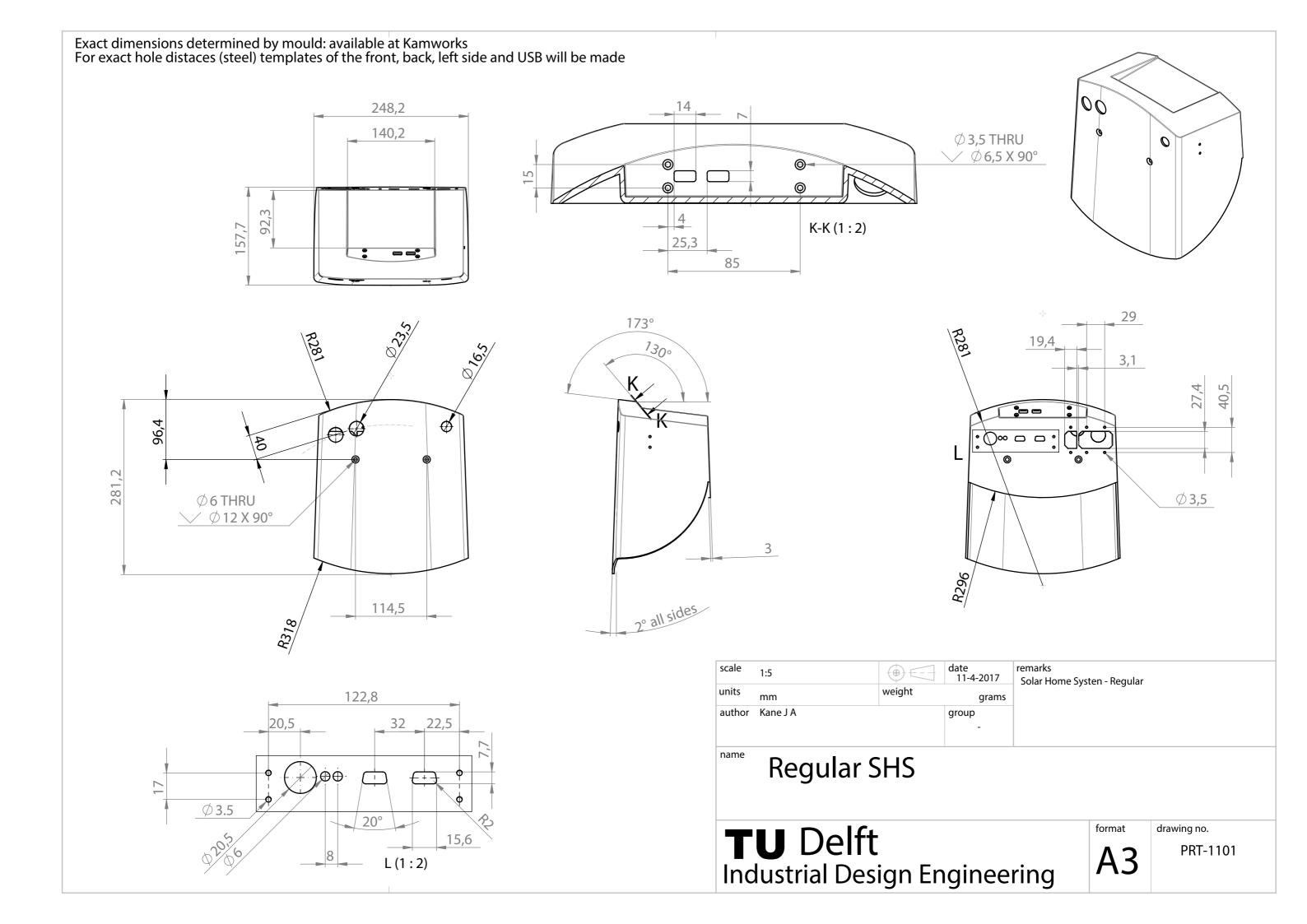
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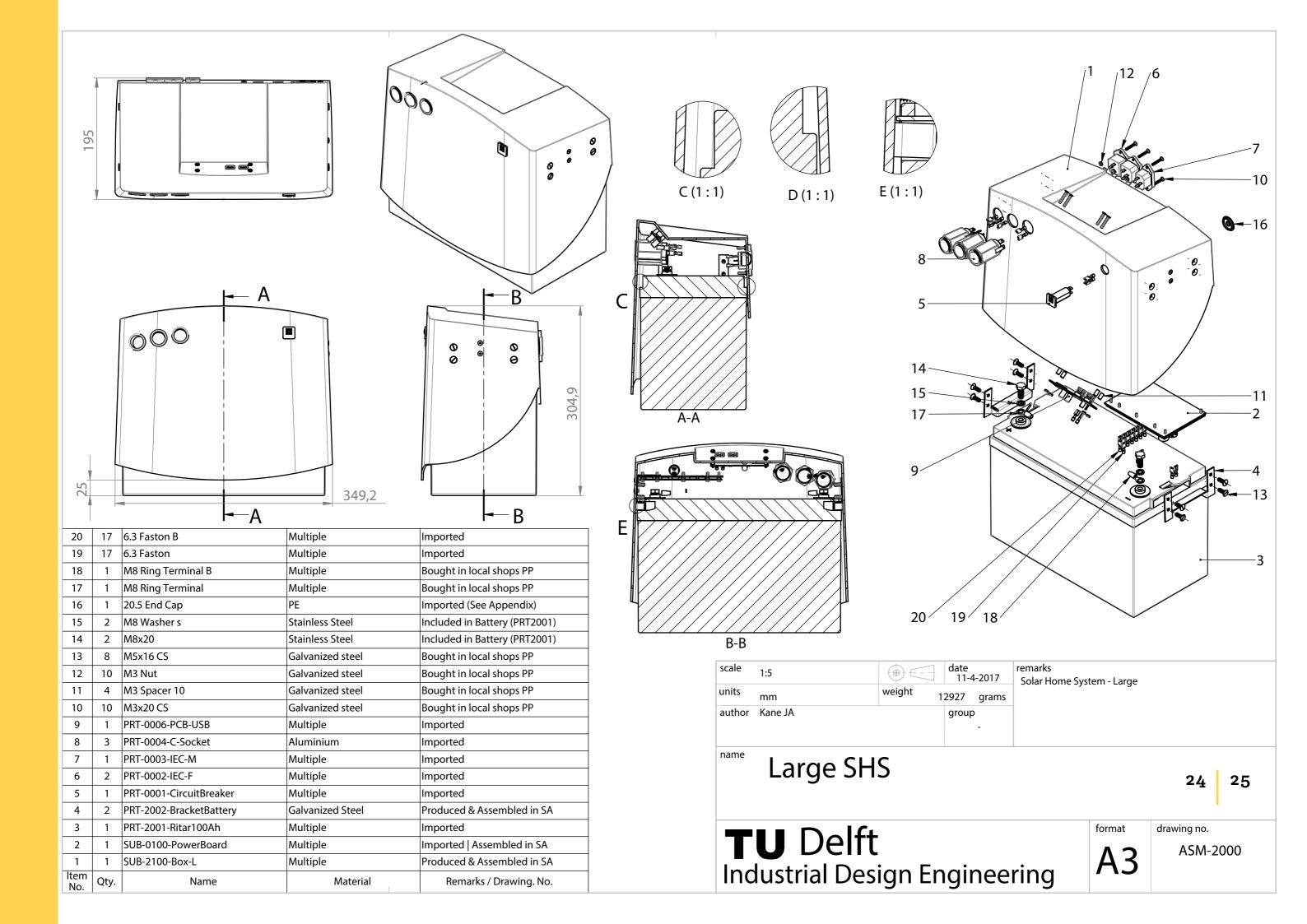
23

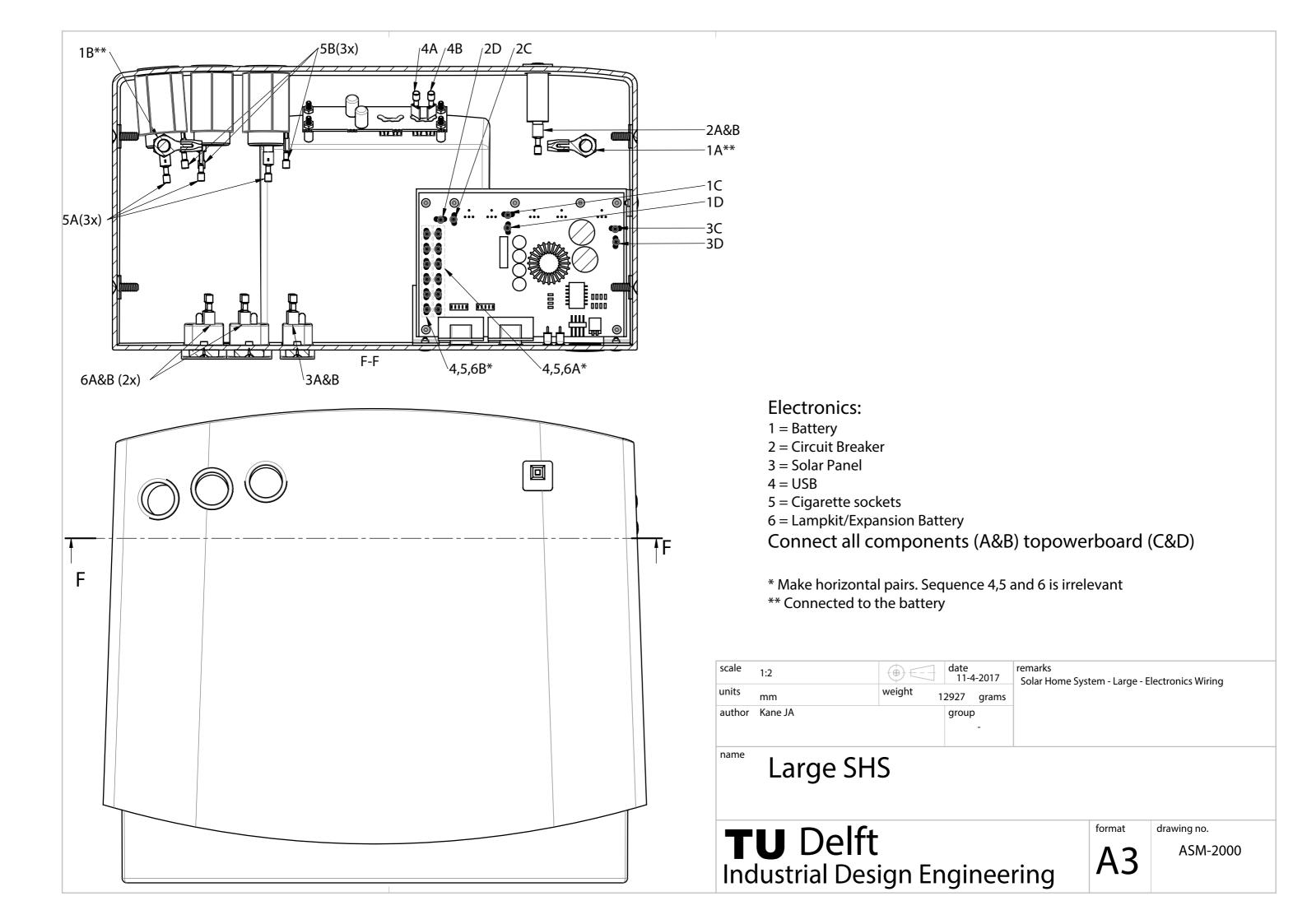
TU Delft Industrial Design Engineering

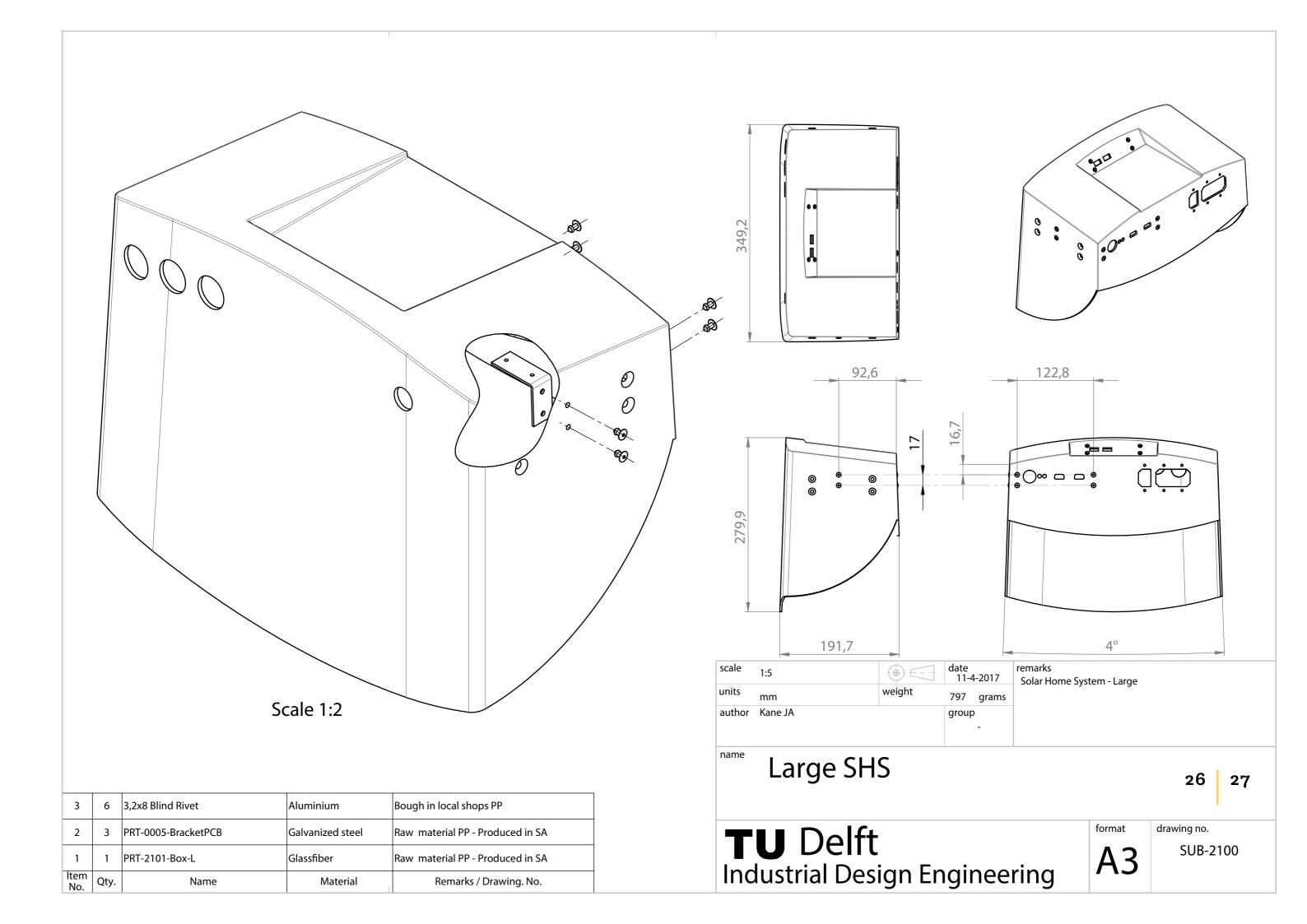
**A3** 

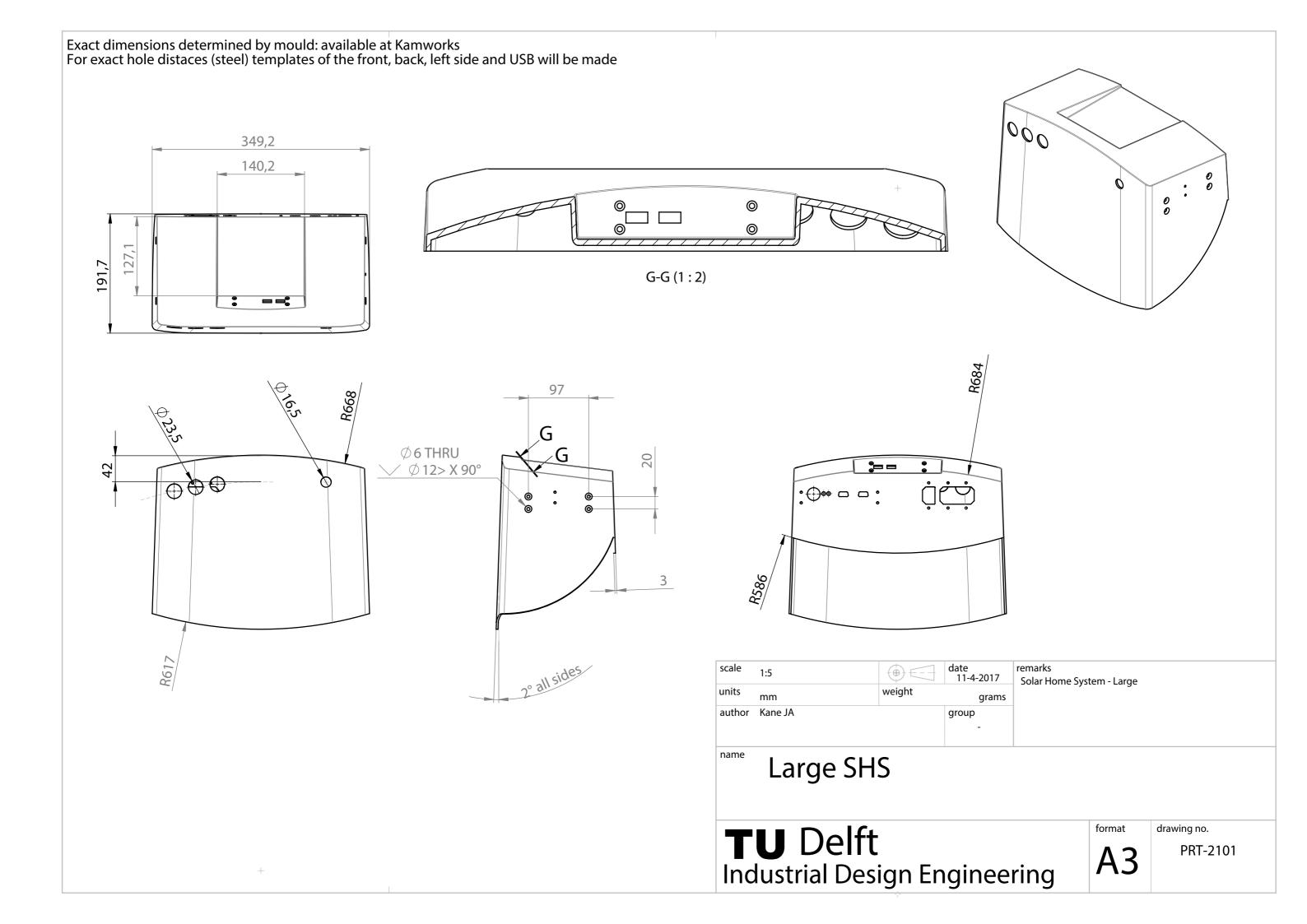
drawing no. SUB-1100

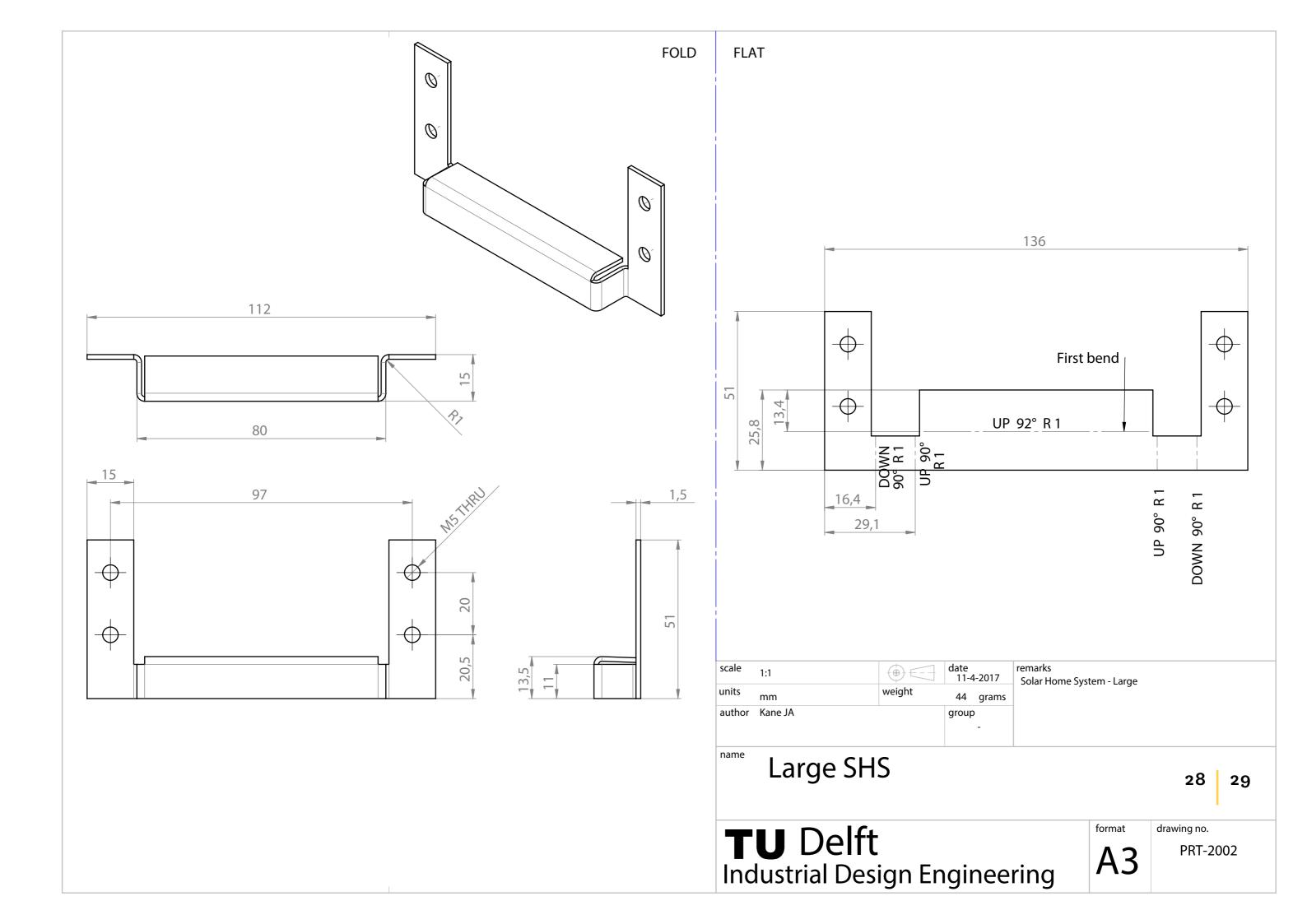


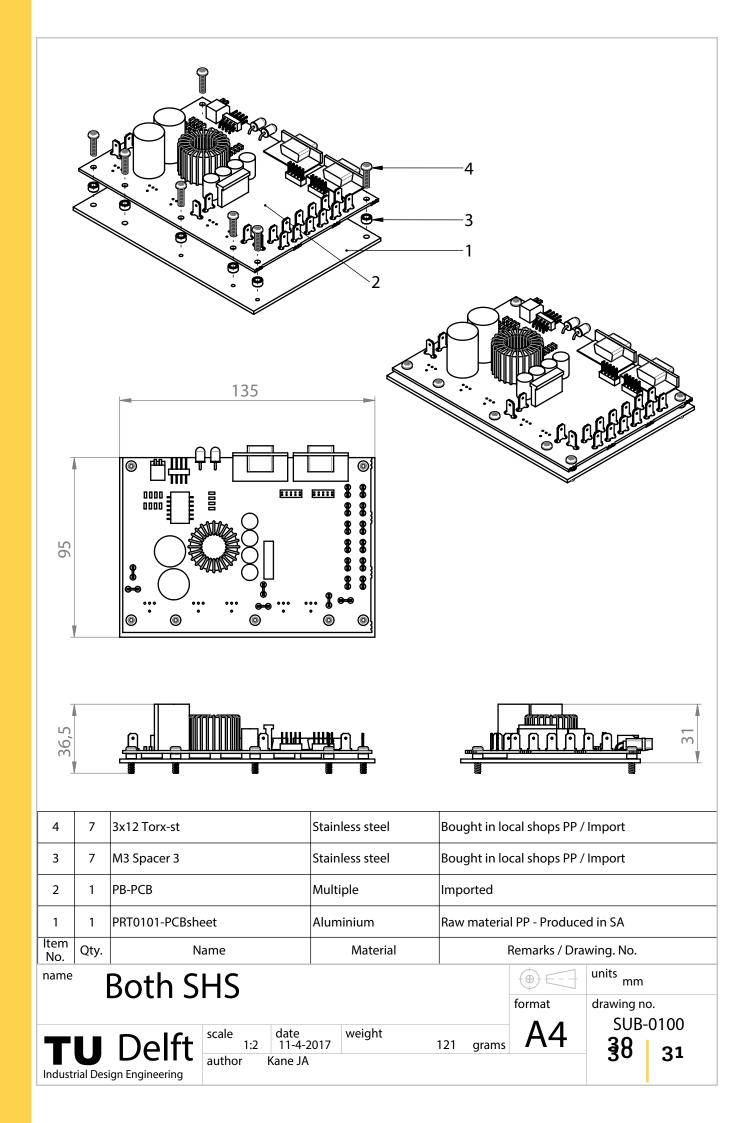


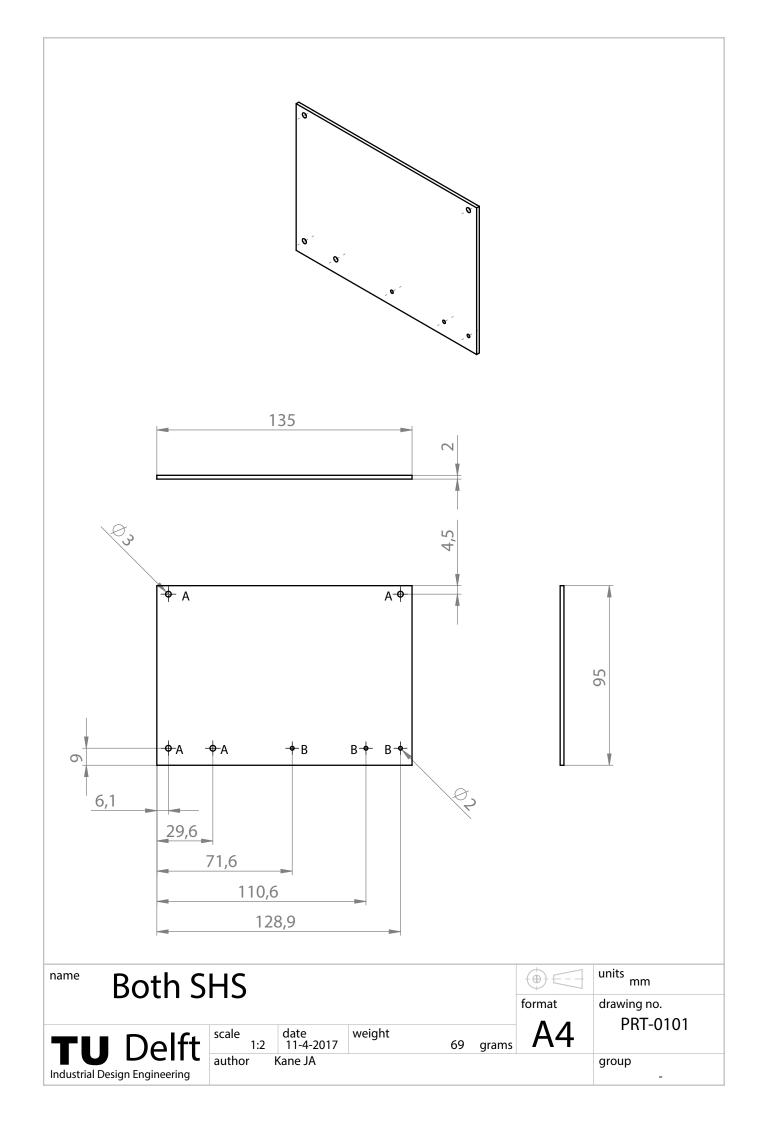


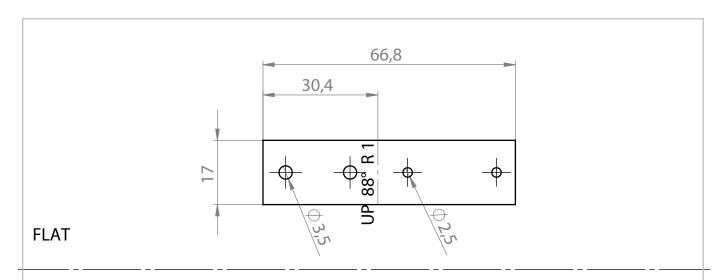




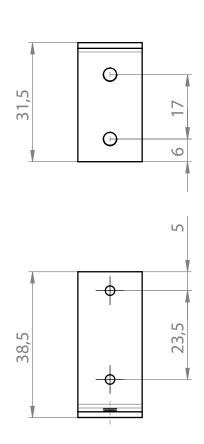


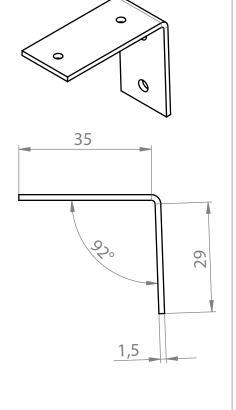




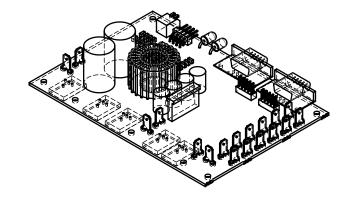


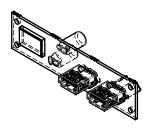
FOLD

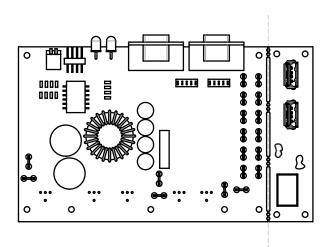




name Both SHS						⊕ € ∃	units mm		
Doil 5	115					format	drawing no		
<b>TU</b> Delft	scale 1:1	date 11-4-2017	weight	13	grams	A4		0005	
Industrial Design Engineering	author	Kane JA					32	33	





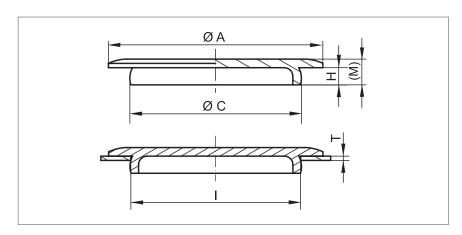


name Both SHS					⊕ € ∃	units mm	
	Donis					format	drawing no. PCBs
71	<b>J</b> Delft	scale 1:2	date 11-4-2017	weight	grams	A4	PCDS
	l Design Engineering	author	Kane JA				group -

# Covers

# **GPN 910**







#### Your KAPSTO® quality benefits:



### Additional information:

Flat design, ideal for closing apertures in cover panels.

Suitable	for casings		Dime	nsions		
Aperture I	Wall thickness T	Α	С	Н	(M)	Order no.
12.0	1.0	16.0	12.3	3.0	5.0	910 / 3280
15.0	1.0	18.0	15.4	4.0	5.0	910 / 2179
17.3	1.0	20.0	17.6	4.0	6.0	910 / 3759
20.0	1.0	35.0	20.5	5.0	7.5	910 / 2967
20.5	1.0	25.0	21.1	2.5	4.0	910 / 0766
25.0	1.5	28.0	26.0	4.0	6.2	910 / 4015
25.5	1.0	38.0	26.0	5.3	7.4	910 / 3040
26.3	2.2	38.0	27.0	7.5	9.5	910 / 3043
26.5	1.5	38.0	27.0	4.3	6.3	910 / 0763
33.0	1.5	36.0	33.5	4.0	6.0	910 / 3790
36.0	2.0	53.0	36.5	5.0	7.0	910 / 5539
39.5	0.9	50.0	40.0	4.0	6.0	910 / 3205
39.7	0.8	50.0	40.4	2.4	4.2	910 / 4010
50.0	1.0	55.0	50.6	4.0	6.0	910 / 3097
53.0	1.5	62.0	53.8	4.0	6.0	910 / 0715
60.8	2.2	66.0	61.5	7.8	9.8	910 / 3044
61.0	1.5	68.0	62.0	4.0	5.8	910 / 0714
64.0	1.5	85.0	64.6	4.1	6.1	910 / 3791
71.0	1.5	76.0	71.5	5.0	7.5	910 / 2713
72.0	3.0	90.0	72.8	7.5	9.5	910 / 3042
74.5	1.5	83.0	75.0	8.0	10.0	910 / 3223
81.5	1.5	90.0	82.0	8.0	10.0	910 / 3222
92.0	3.0	103.0	93.0	7.7	9.7	910 / 3277
100.0	2.0	109.0	101.0	5.0	7.0	910 / 4395

Size in mm

Colour and material alternatives, additional sizes, bespoke designs and technical cleanliness on request. For more information about materials, colours, drawings and application of our items, please see page 114/115.

>> You also might be interested in the following products: GPN 300 F, GPN 600, GPN 915

Material: PE-LLD Colour: Black





## I Building moulds for BB production

As mentioned in the report, the VRTM process is slightly adjusted based on Kamworks' experiences with the battery box. Where the VRTM process is explained in the literature, this appendix will describe the process towards two production moulds for Kamworks' battery boxes.

The line drawings on these pages show the first setup for making the production moulds. At first, the shape of the battery boxes are translated into solid blocks with a surrounding flange of 20 centimetre.

The flange, coloured brown in the drawing, is made from leftover wood from Kamworks' workshop. The block (yellow) is made from 6 and 12 millimetre MDF. First the blocks are produced, after which the flange is attached to it.

The block is split up in slices of 6 and 12 millimetre. These sections were printed [1], traced on MDF [2] and sawed [3]. After applying glue [4], the sections are joined layer by layer [5]. The dimensions are compared to the battery [6], after which some final adjustments and finishing are done [7, 8].

When the block is smooth, the flange is built around it [9]. The flange is made from different kinds of wood [10]. When all parts are fixed, edges are finished and

body filler is applied to close gaps and give the block a hard top layer [11]. The block is sanded and spray painted with car paint [12]. With the car paint applied, the blocks are finished and the moulds can be made.

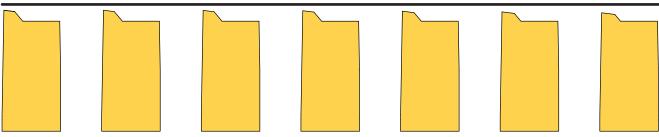
The block is waxed to avoid the mould sticking to it. The first half of the mould is made by applying glass fibre and resin to the block [13]. When the fibreglass is dry, it is separated from the block [14]. This first mould is the outside shape of the box. The second half of the mould is made based on this one, so this mould is smoothed first [15].

Before the second half of the mould is made, a first box is made by hand lay-up [16]. This prototype shows if the draft of the mould and the dimensions of the box are correct. When approved, foam is applied that has the same thickness as the product [17]. When the mould is fully covered with foam, edges are finished and the foam is waxed [18]. Thereafter the inserts to create a vacuum and allow the resin to flow through the moulds are applied [19]. The second mould is made by applying glass fibre and resin on the foam and the inserts. After all this, the two mould sets are ready for use. The first batch [20] can be used for production.



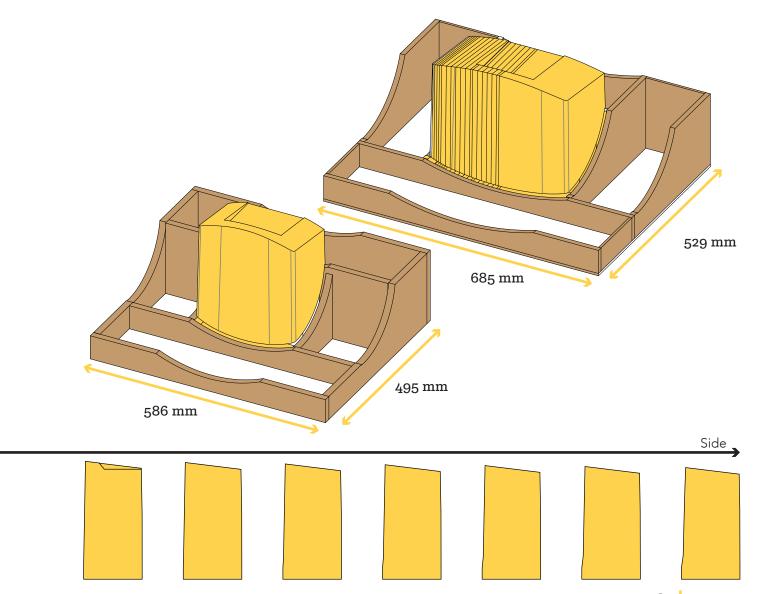


#### Middle

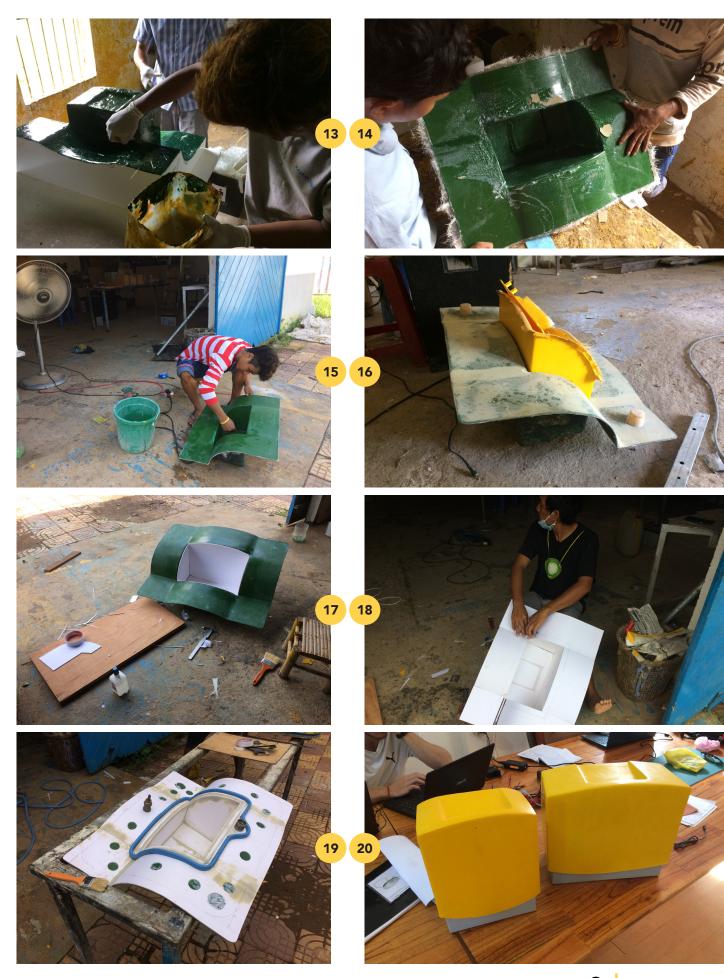












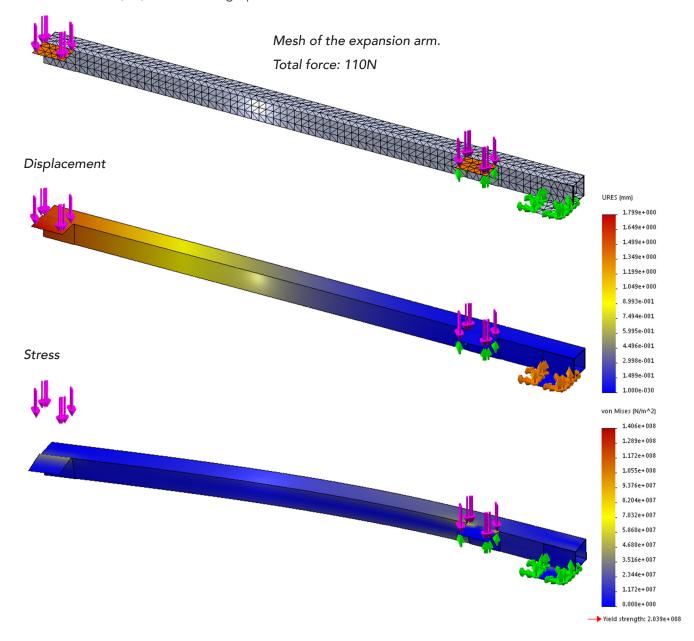
The final profile dimension is determined on 30x30x1 mm (Galvanized steel). This dimension is based on the available profiles in Cambodia and the simulations that are found on this page.

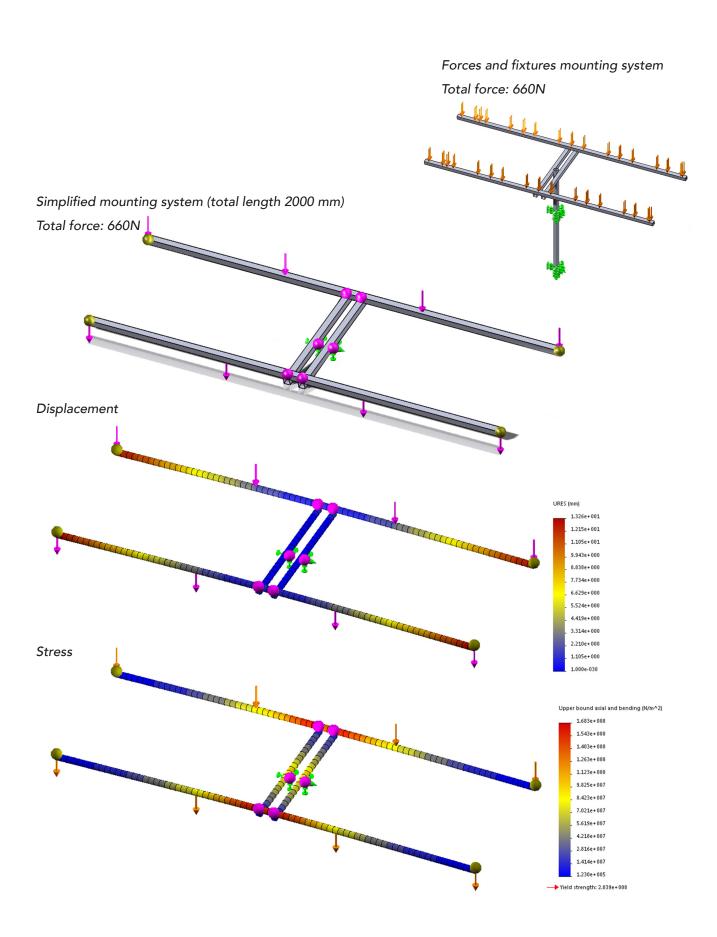
Besides the yield strength that cannot be exceeded with a safety factor of 2, the displacement was taken into account too. Since the accuracy of the panel was determined on 2°, the deformation should fit into this requirement.

On the right page a simplified model of the mounting system is visualized. The length of the horizontal supports is the length of the actual supports + the extension arms (2m). With the large panel's load of

approximately 11kg ( $\approx$ 110N), 660N force was applied to the mounting system (3 panels x110N x 2SF). The stresses stay below the yield strength, while the displacement is 13,6 milimeter. This comes down to a deviation of 0,78°: well within the required accuracy.

Below a simulation is given of on of the arms. Also here, the yield strength is not exceeded and deformations are acceptable.



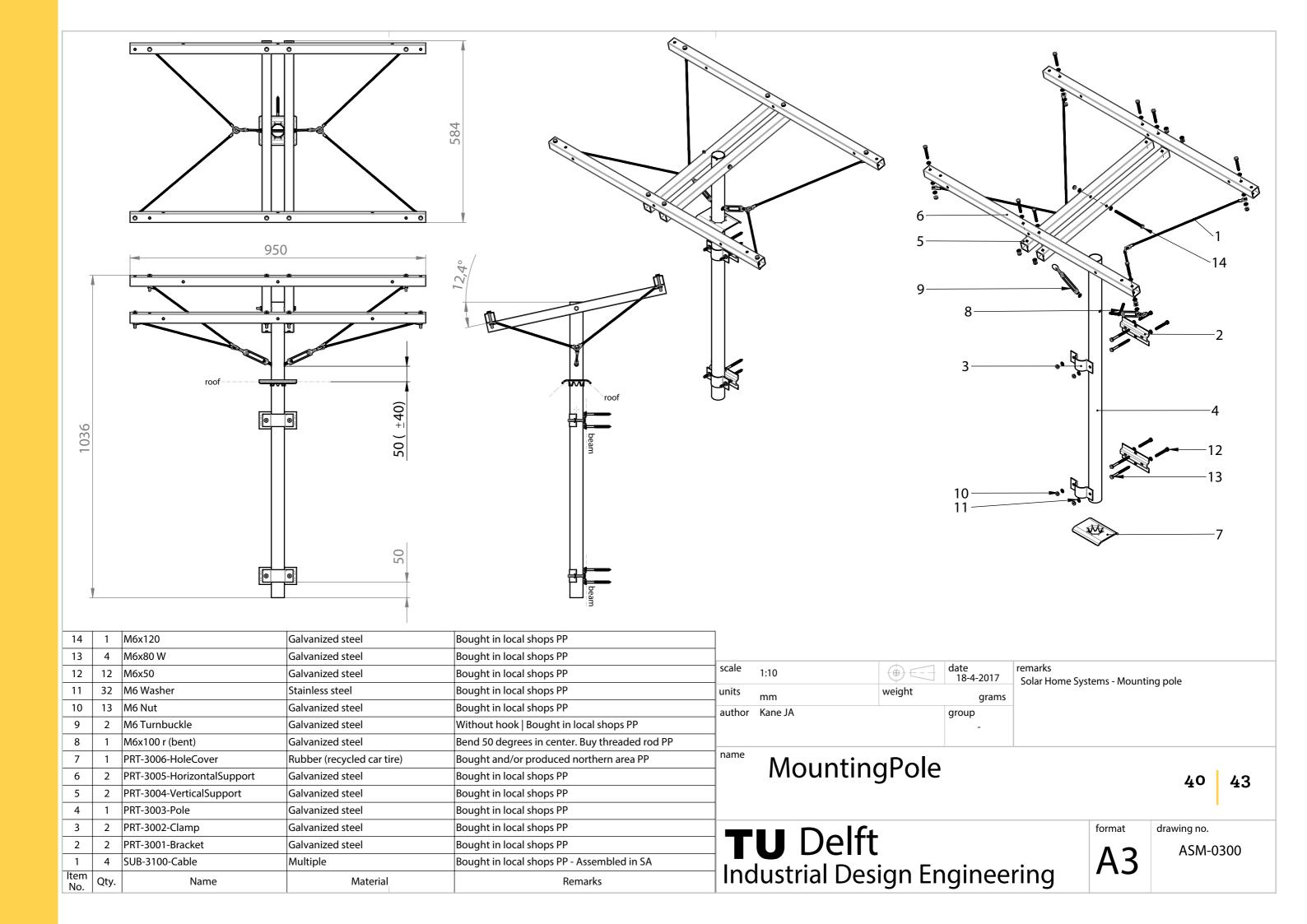


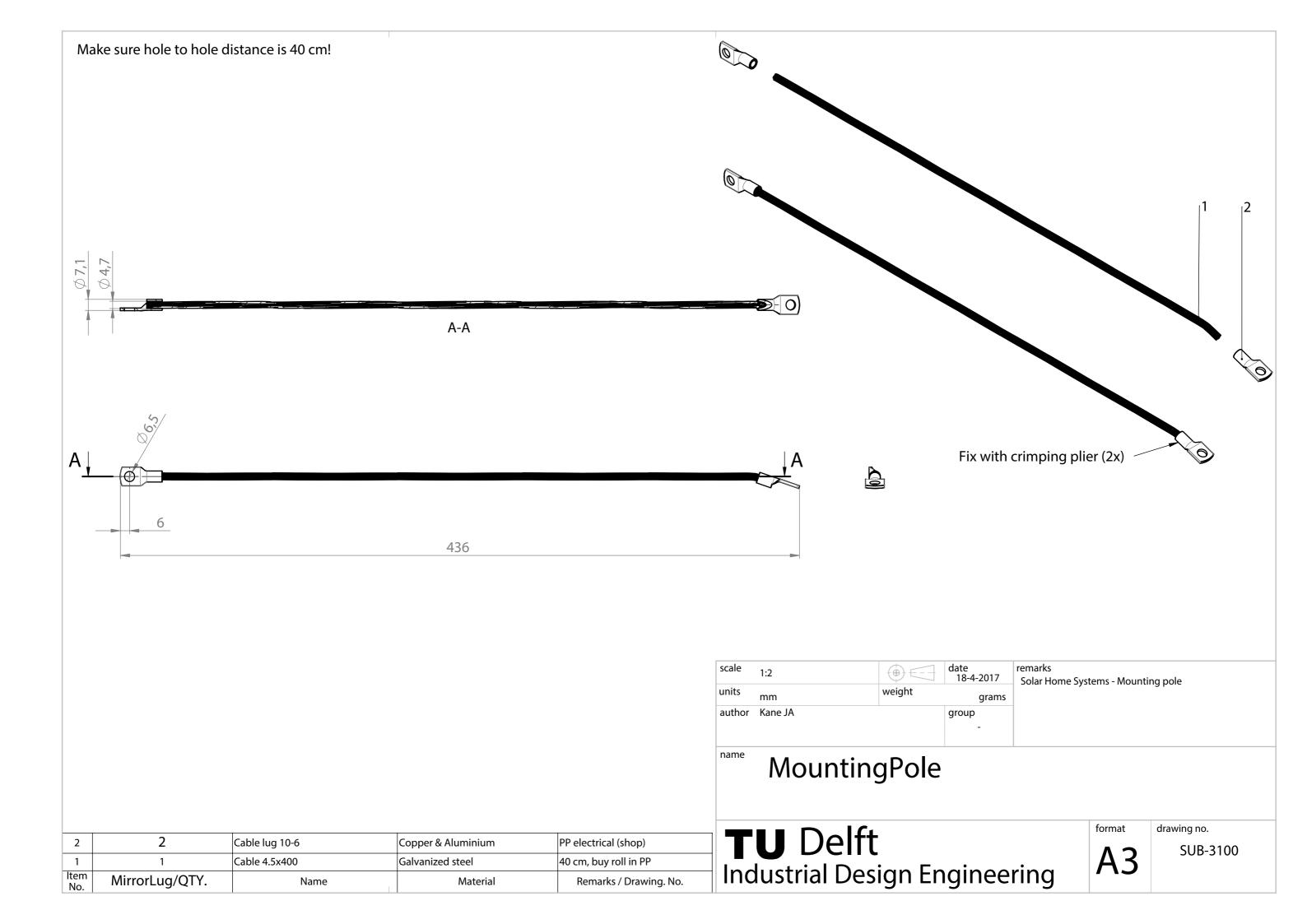
## K Technical drawings Solar panels and mounting pole

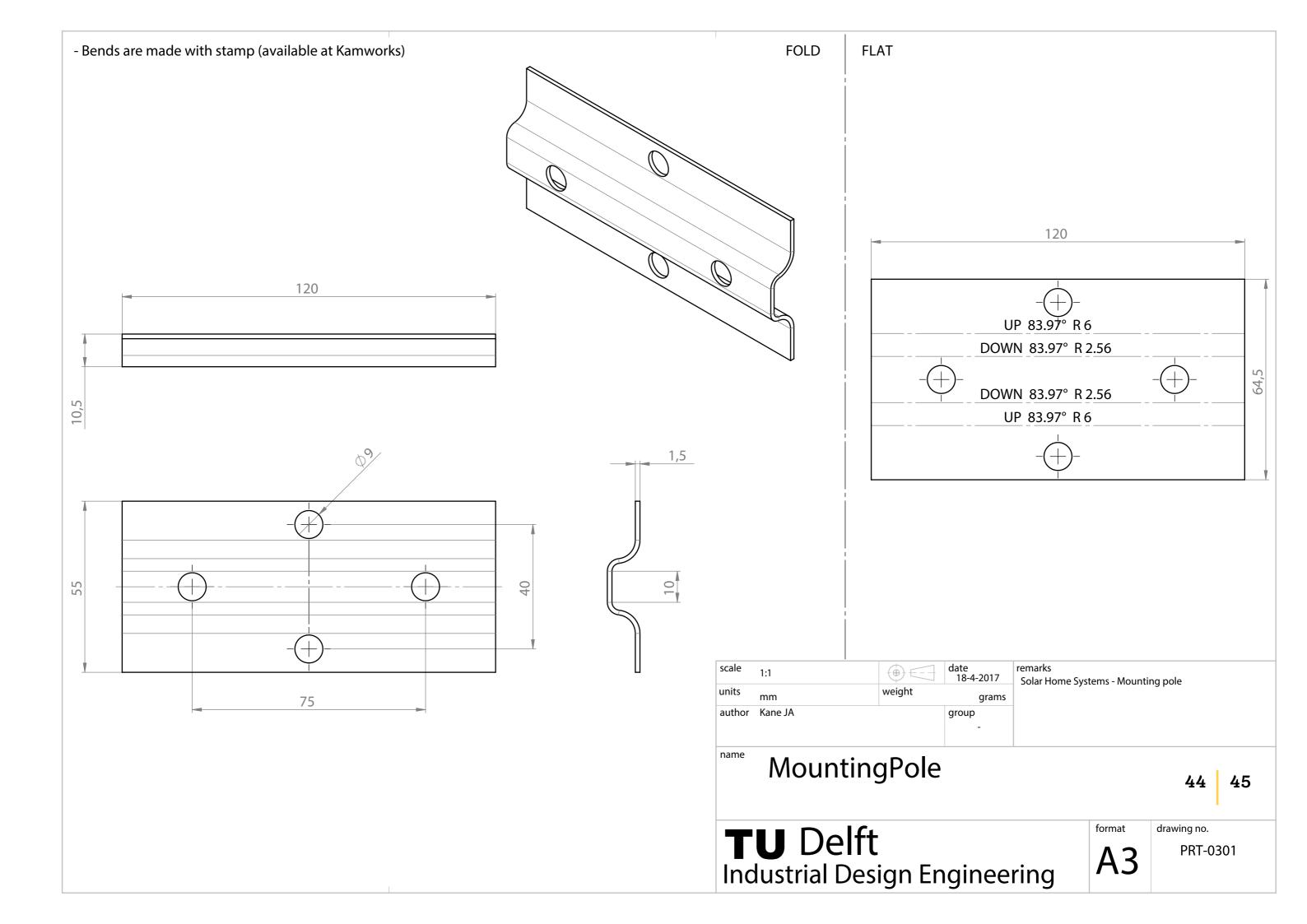
In this section the technical drawings of the mounting pole and solar panels are provided. An overview of the parts can be found, which is used for the cost estimation of the redesign (appendix L).

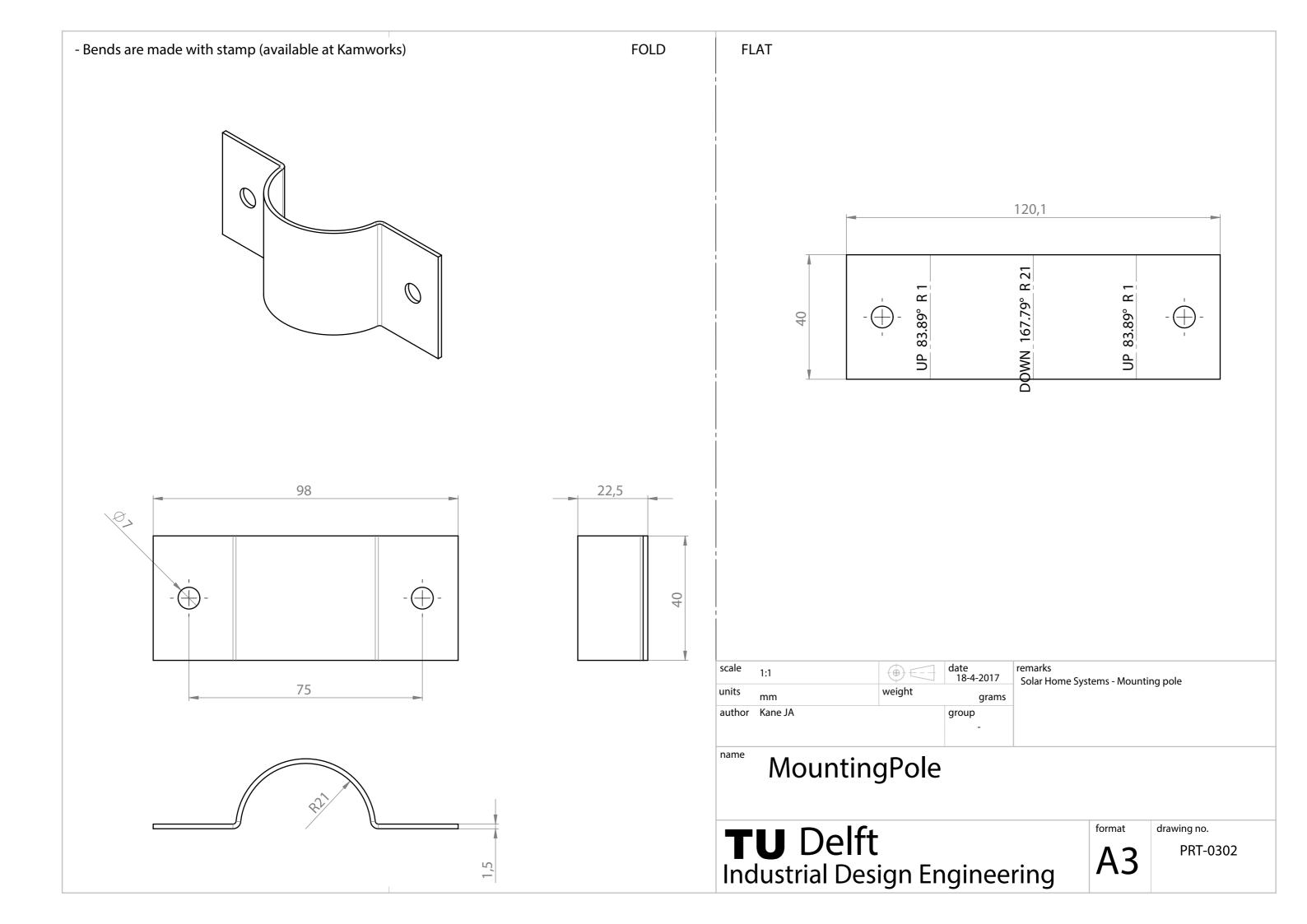
The technical drawings are divided in two parts, indicated with a yellow bar (see the right page). The first part is the mounting pole the parts that are used in this assembly. The second part is the solar panels and the supports that are used to attach the panel to the mounting system.

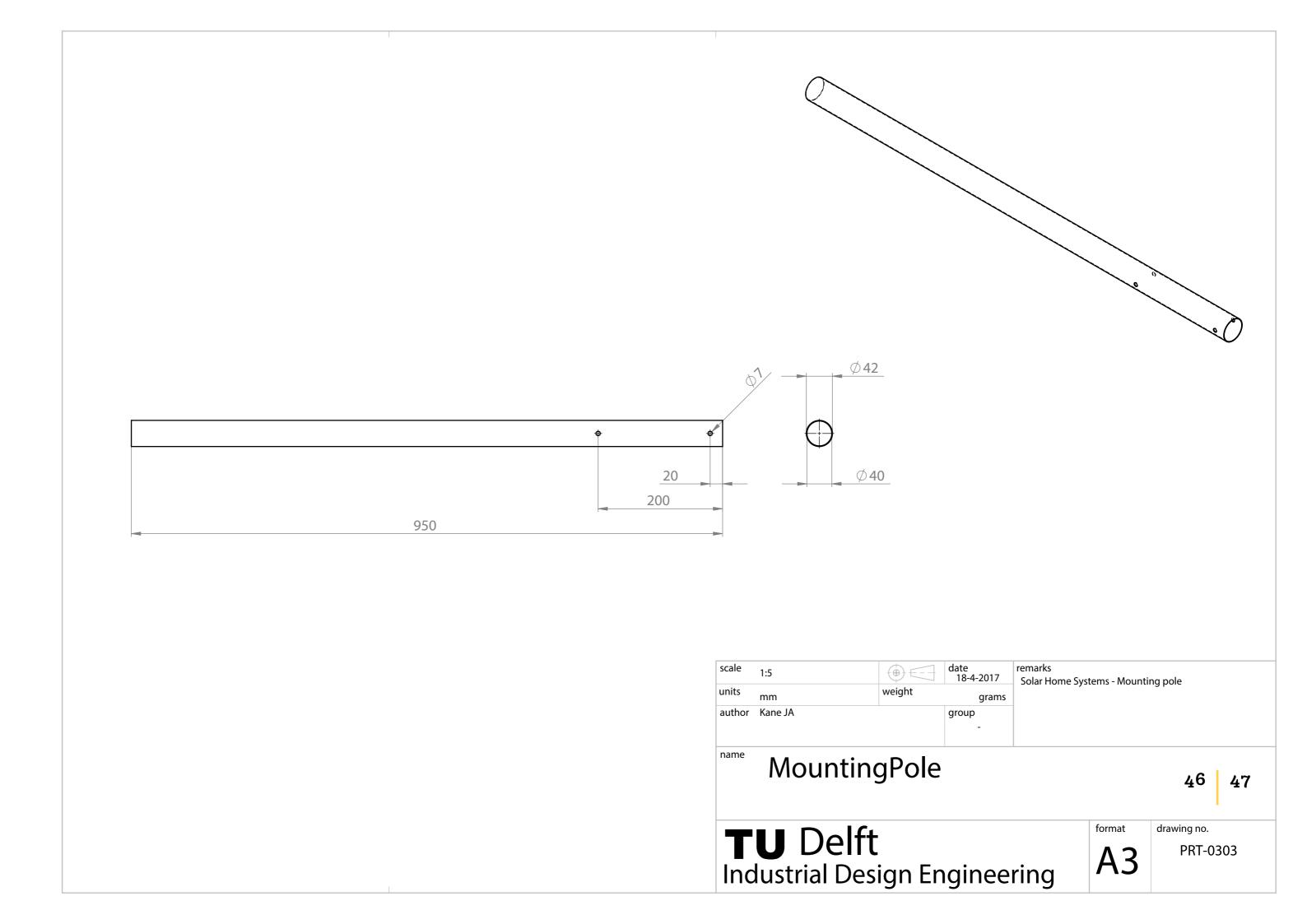
Standard parts (sockets, screws, etcetera) are only included in the CAD model. They cannot be found in these drawings.

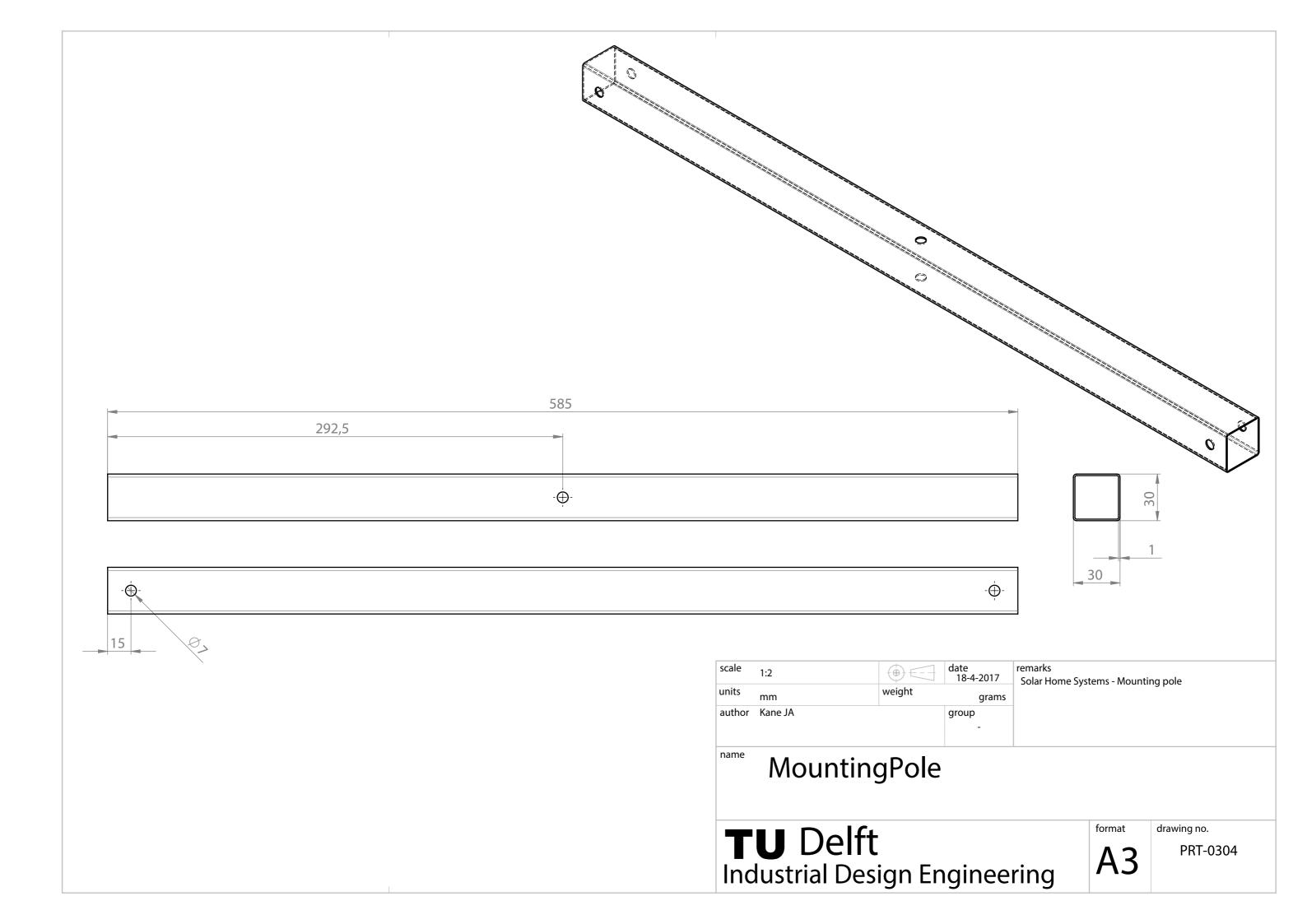


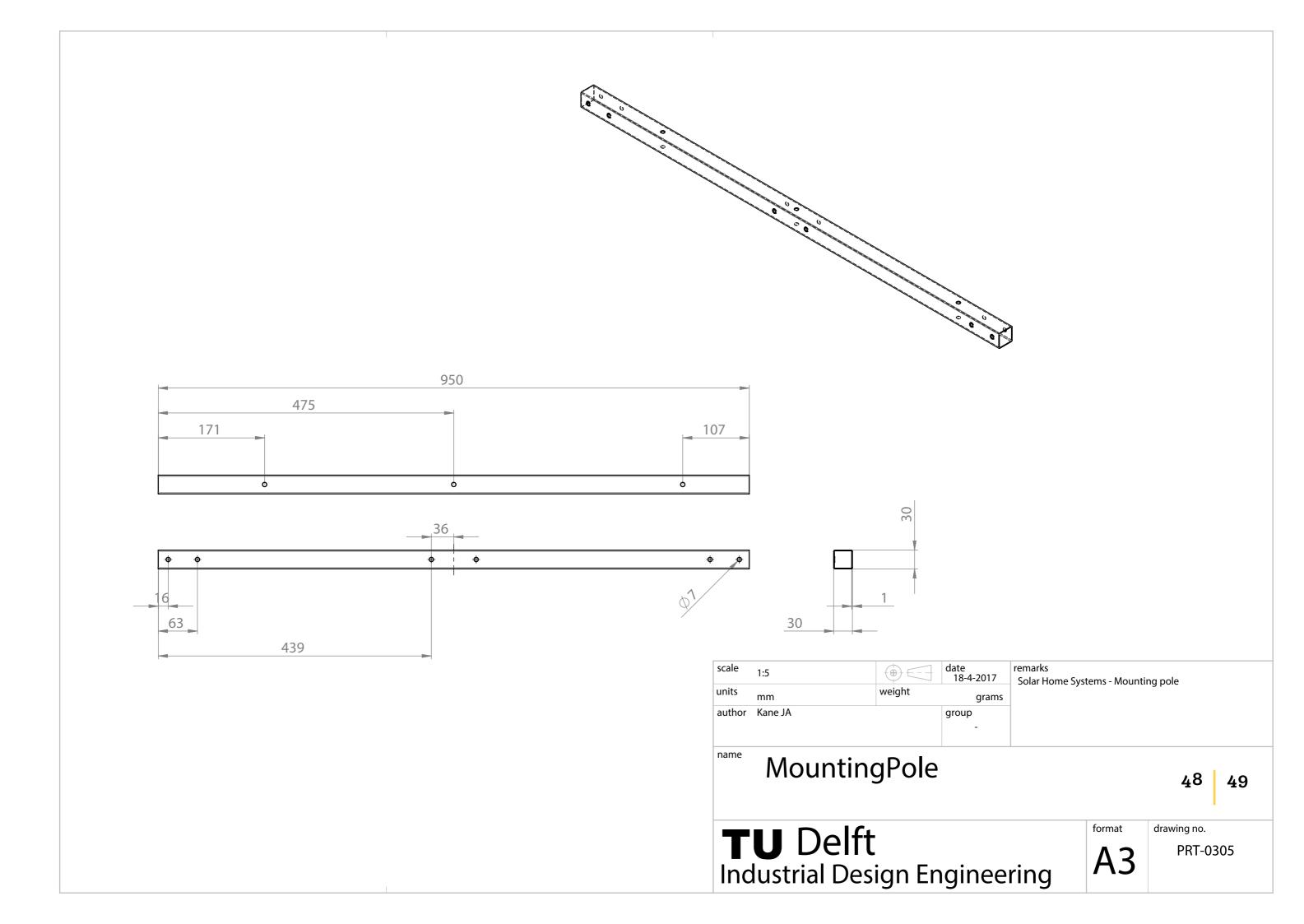


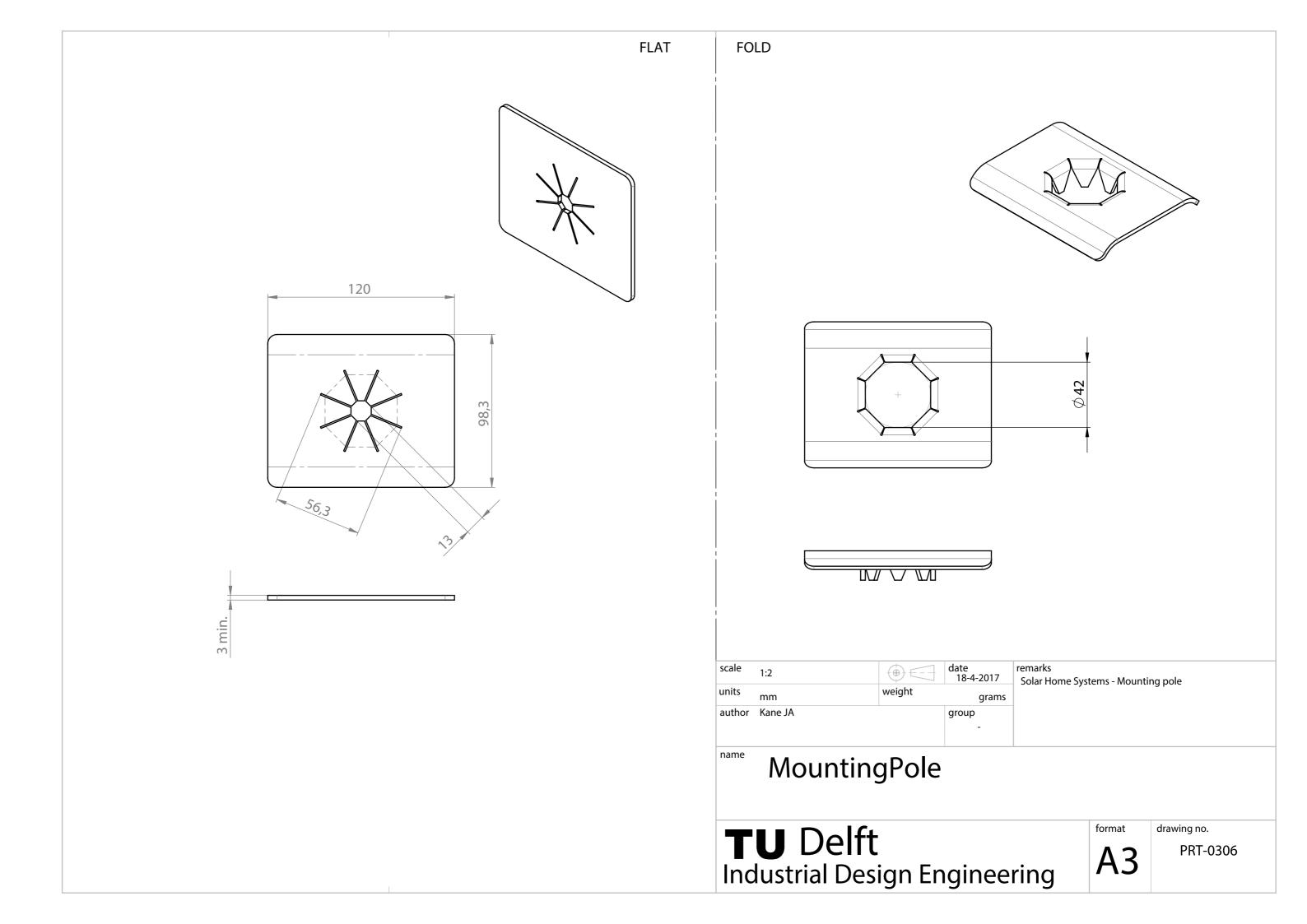


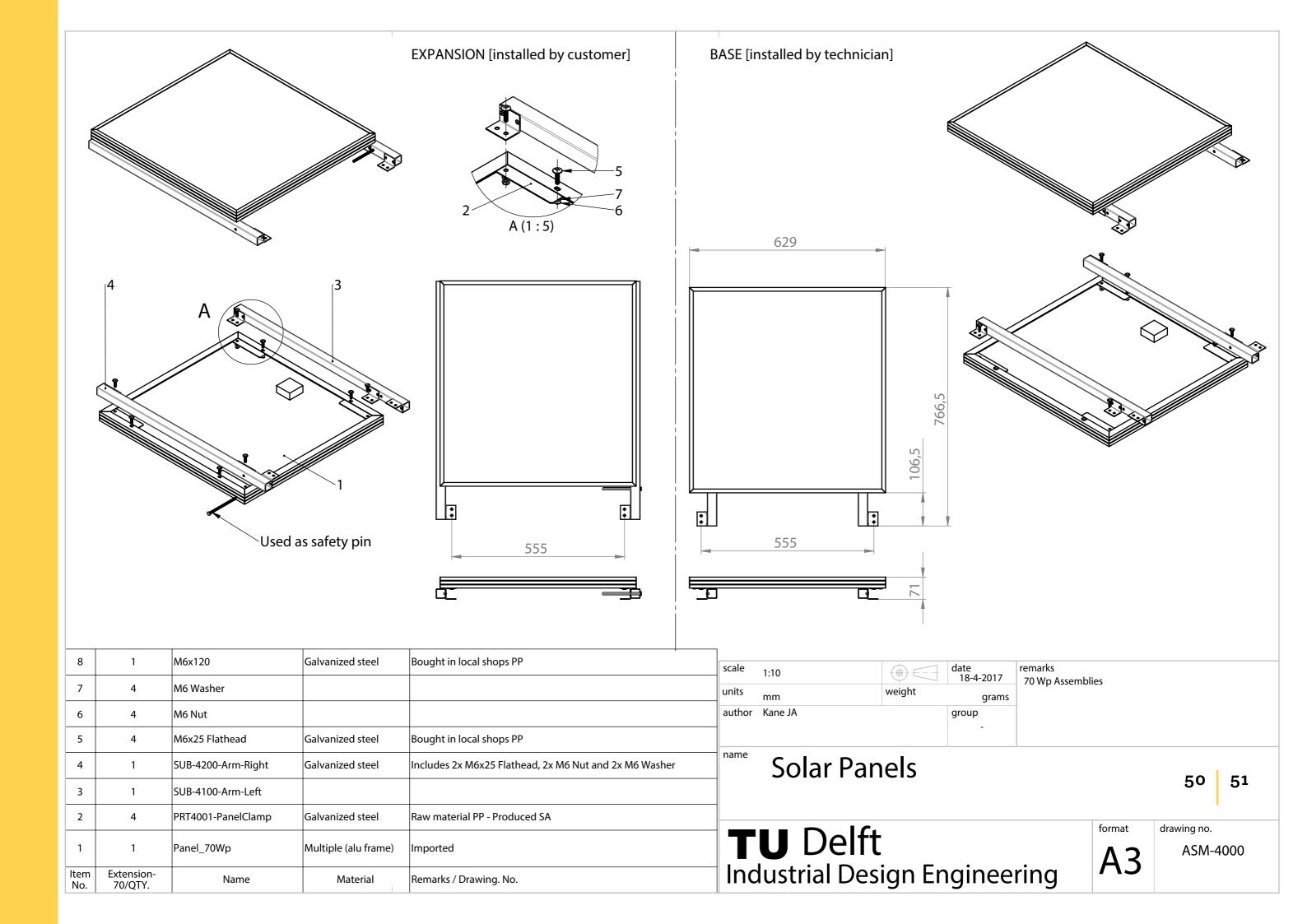


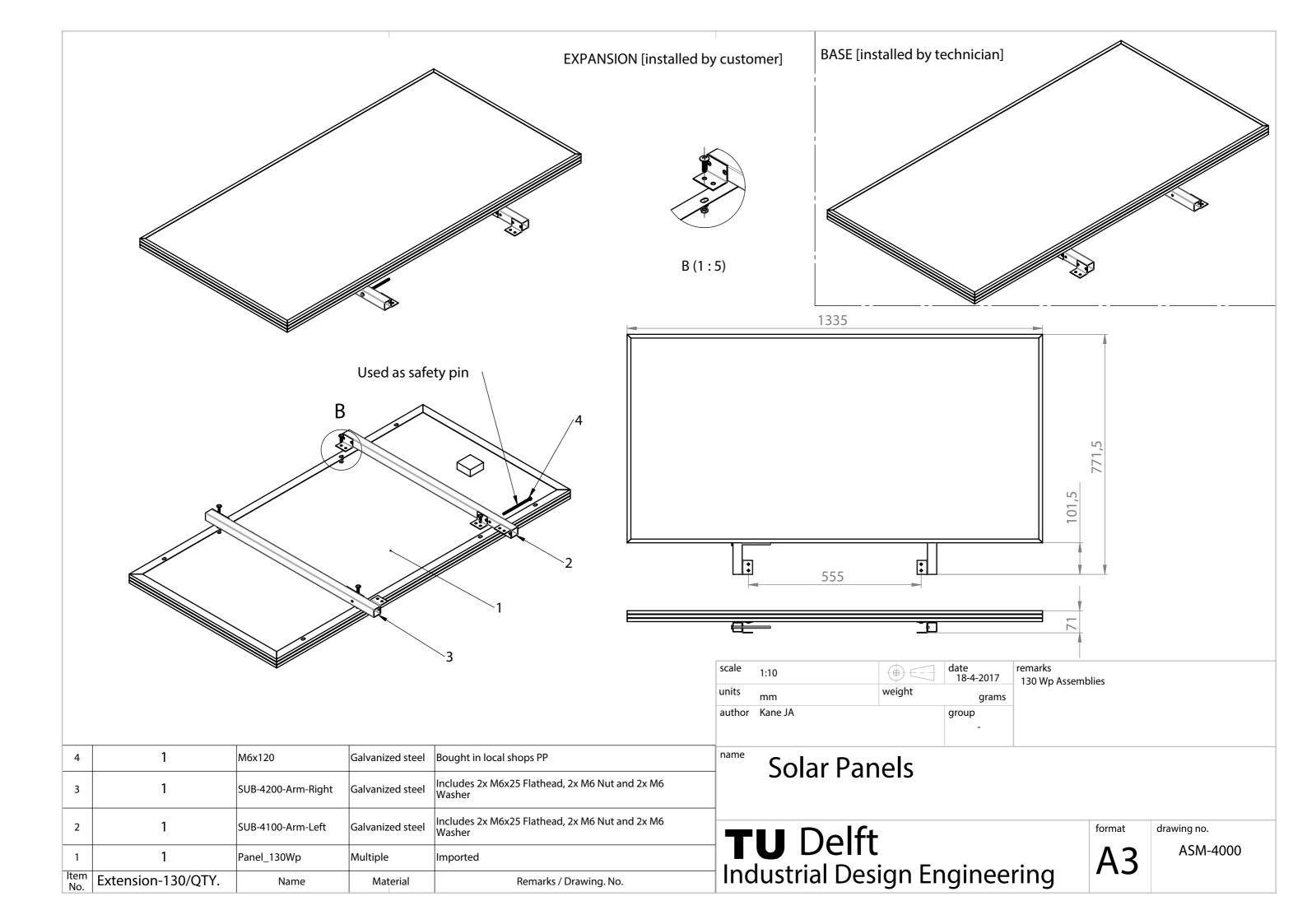


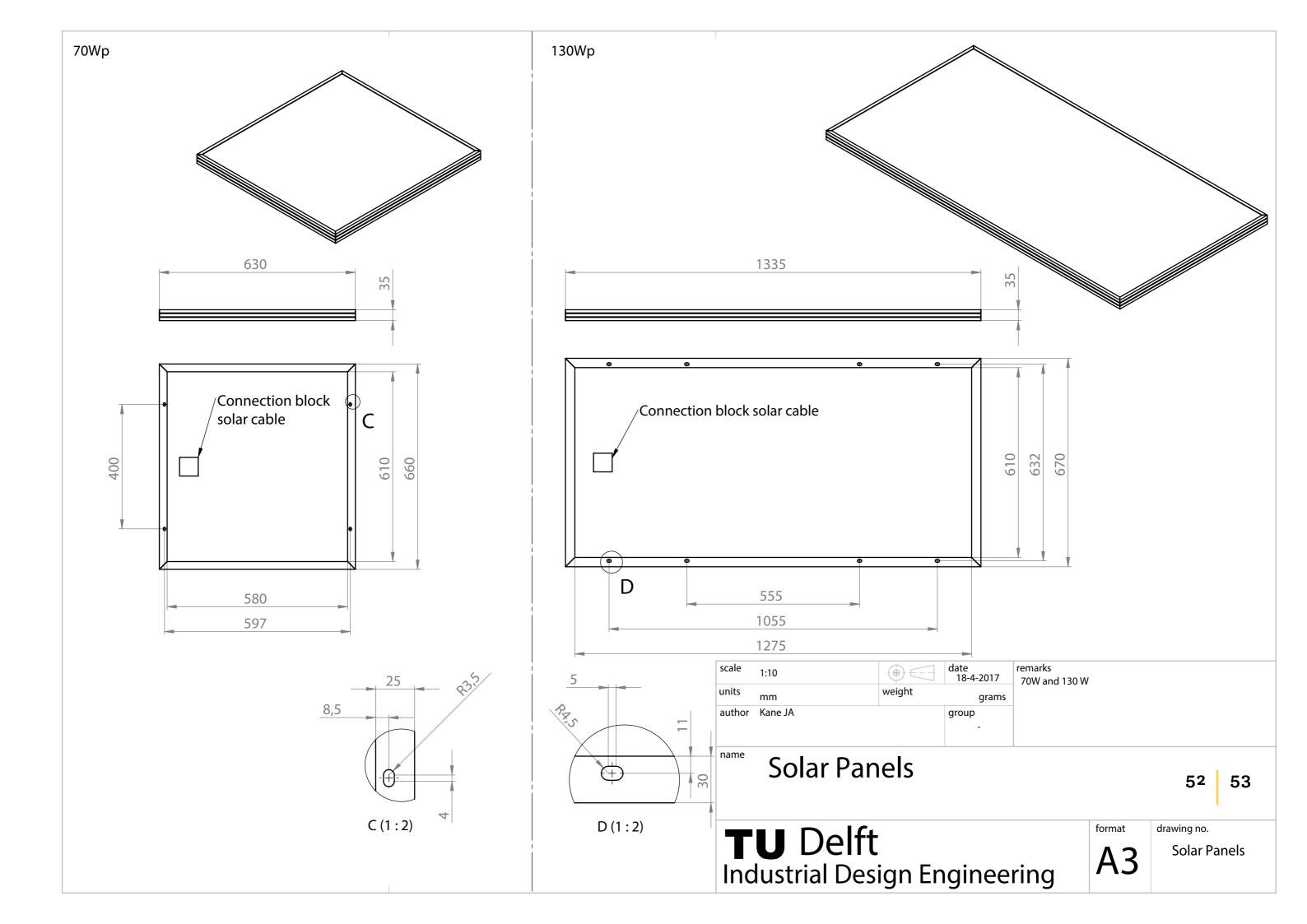


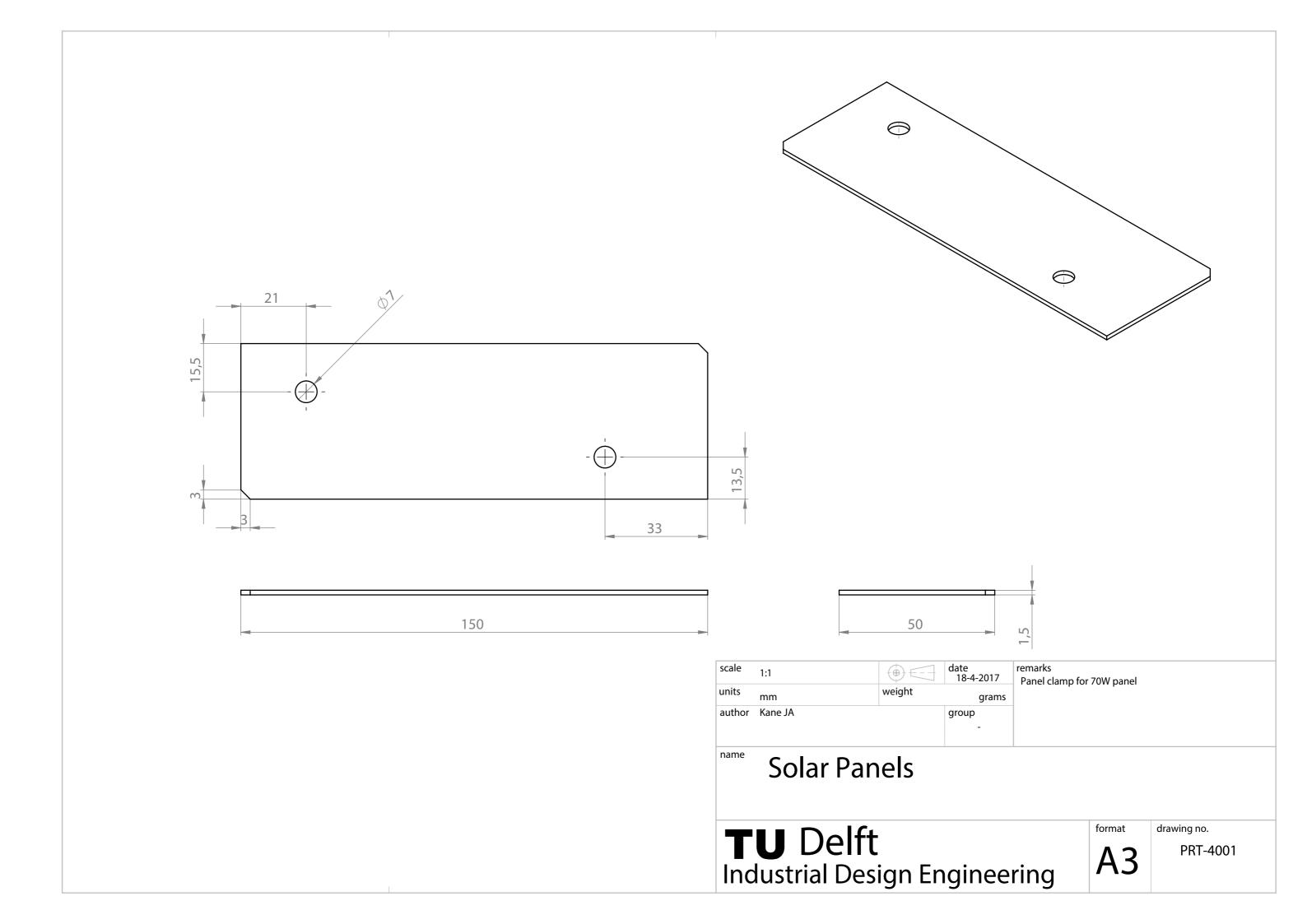


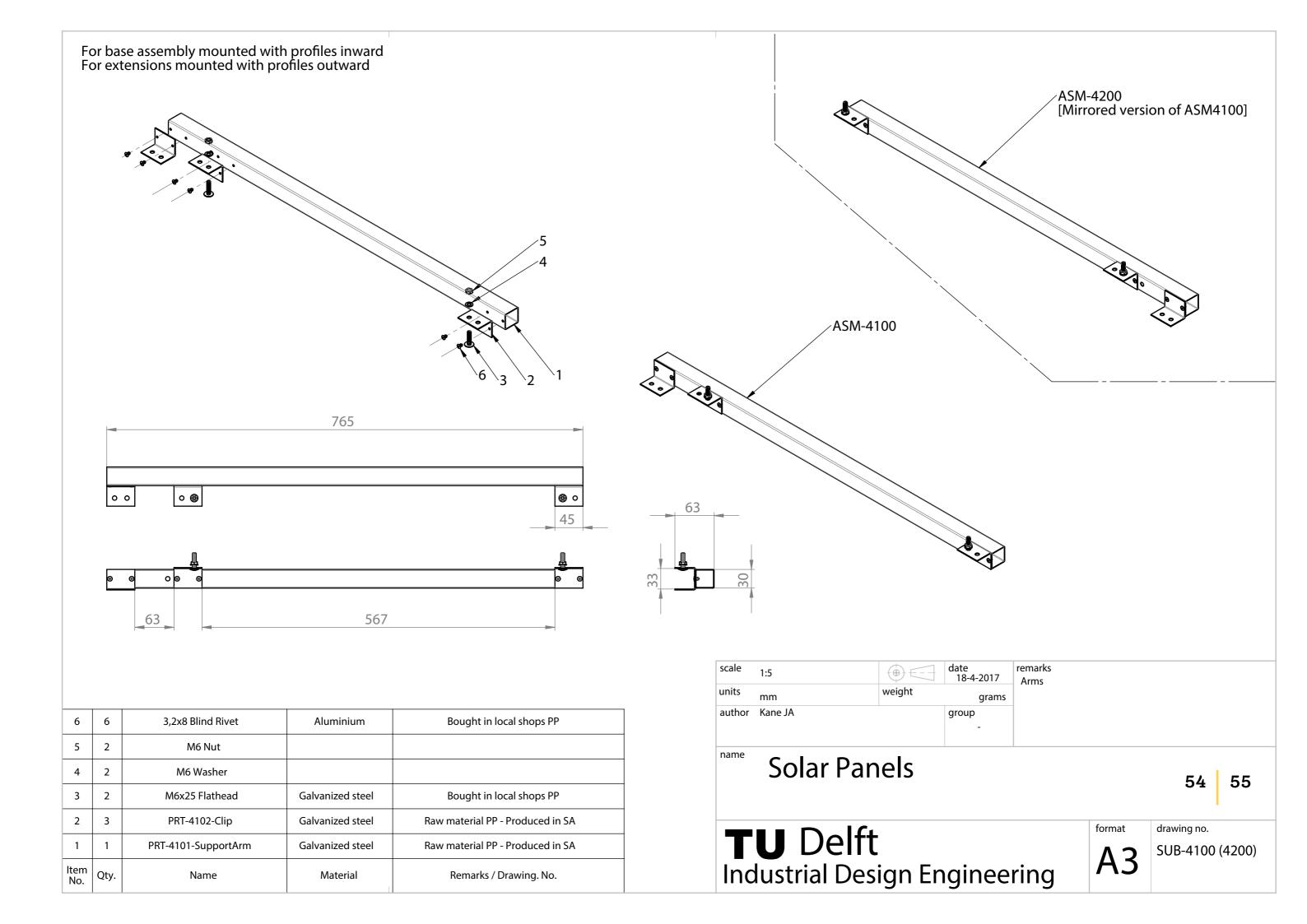


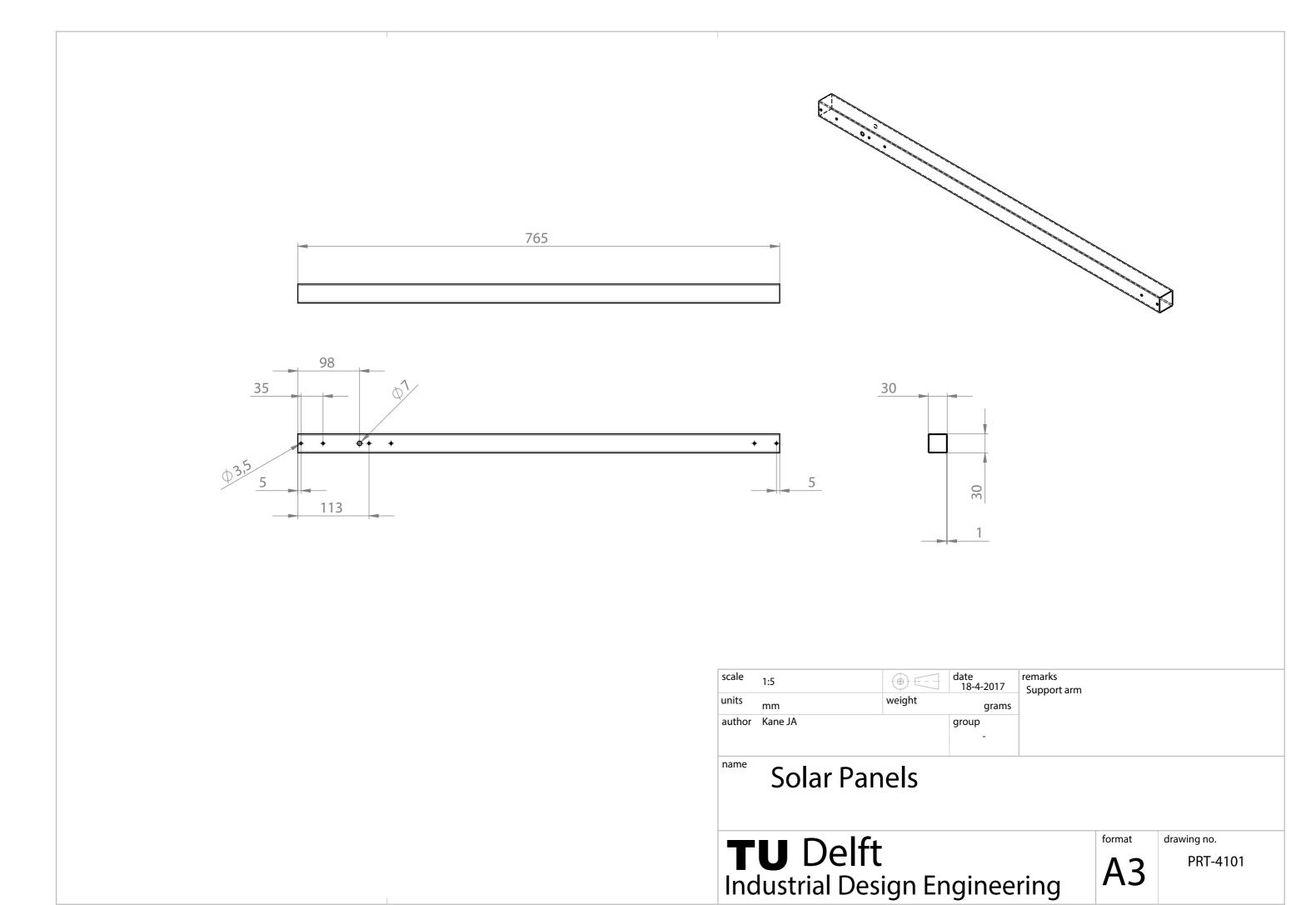


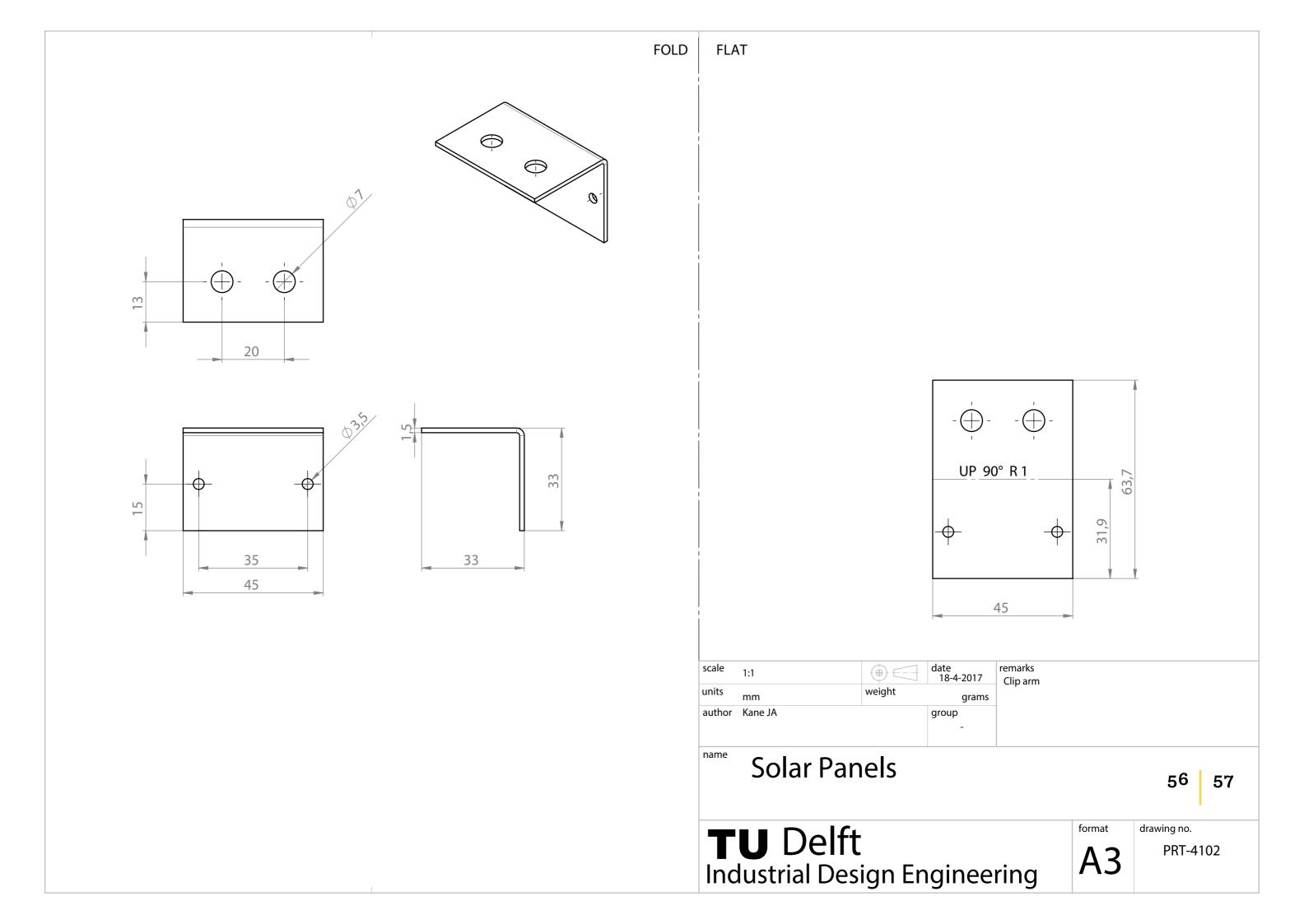












# L Cost price calculation

On the following pages a calculation of the cost price (for the battery box and the mounting system) is given. It is an estimation of costs for all parts and components. The labour costs, packaging and accessories are not included in the calculation.

1	Description	Price (Riel)	Price (USD)	(USD) Per	Material	Bought in	Remarks	SW-Name	Amount Regular SHS	Cost	Amount Large SHS	Cost
vy 100 Ah (Ritar)         \$ 96,14 Piece         Fiberglass         Import         Produced SA         Price estimated         PRT-1010-Box-IR         10           ack of box         5 5,00 Piece         Fiberglass         Produced SA         Price estimated         PRT-1010-Box-IR         10           box         5 5,00 Piece         Fiberglass         Produced SA         Price estimated         PRT-1010-Box-IR         10           box         0,11 Piece         Fibertronics         Incal shops         PP         PRT-0004-C-Scoket         2           cket female         5 0,19 Piece         Electronics         Incal shops         PP         PRT-0003-IC-Acket         2           cket female         5 0,19 Piece         Geletronics         Incal shops         PP         PRT-0003-IC-Acket         2           cket female         5 0,10 Piece         Geletronics         Incal shops         RPT-0003-IC-Acket         2           cket female         5 0,10 Piece         Galv Steel         PRT-0003-IC-Acket         2           cket Male         5 0,10 Piece         Galv Steel         Rwa material PP         PRT-0003-IC-Acket         2           cket Male         5 0,10 Piece         Galv Steel         Rwa material PP         PRT-0003-IC-Acket         2 <t< td=""><td>Battery 55 Ah (Ritar)</td><td></td><td></td><td></td><td></td><td>Import</td><td></td><td>PRT-1001-Ritar55Ah</td><td>1</td><td></td><td>0</td><td>· \$</td></t<>	Battery 55 Ah (Ritar)					Import		PRT-1001-Ritar55Ah	1		0	· \$
Box         S S ON Piece         Fleetglass         Produced SA         Price estimated         RPT-2010-Box4         0           Powerboard + USB)         \$ 5,00 Piece         Fleetglass         Produced SA         Price estimated         RPT-2010-Box4         0           Powerboard + USB)         \$ 3,00 Ser         Electronics         Local shops         PP         RPT-2000-C-Socket         2           Kekt Female         \$ 0,17 Piece         Electronics         Local shops         PP         RPT-2003-EC-M         2           Kekt Female         \$ 0,19 Piece         Electronics         Local shops         PP         RPT-2003-EC-M         2           Kekt Female         \$ 0,19 Piece         Electronics         Local shops         PP         RPT-2003-EC-M         2           By sheet PCB         \$ 0,10 Piece         Aluminium         Local shops         RP         RPT-2002-EC-M         3           By sheet PCB         \$ 0,10 Piece         Galv Steel         Produced SA         Raw material PP         RPT-2002-EC-M         3           By child         \$ 0,00 Piece         Galv Steel         Produced SA         Raw material PP         RPT-2002-EC-M         1           By child         \$ 0,00 Piece         Galv Steel         Produced SA         Raw m	Battery 100 Ah (Ritar)			16,14 Piece		Import		PRT-2001-Ritar100Ah		- \$	H	\$ 96,14
Box         Float         Float gests         Produced SA         Price estimated         RPT-2001 Box-L           acted sockert         S 35,00 Set         Electronics         Incard shops         PP         RPT-00004-CS-Cket         2           acket Famile         S 0,71 Piece         Electronics         Local shops         PP         RPT-00004-CS-Cket         2           Acket Malle         S 0,02 Piece         Electronics         Local shops         PP         RPT-00004-CS-Cket         2           Acket Malle         S 0,03 Piece         Electronics         Local shops         PP         RPT-0003-EC-F         2           at PGB         S 0,02 Piece         Aluminium         Produced SA         Raw material PP         RPT-0003-EG-F         2           Arbolder         S 0,03 Piece         Galv Steel         Produced SA         Raw material PP         RPT-0002-BradketPGB         3           Arbolder         S 0,03 Piece         Galv Steel         Produced SA         Raw material PP         RPT-0002-BradketPGB         3           Arbolder         S 0,04 Piece         Galv Steel         Produced SA         Raw material PP         RPT-0002-BradketPGB         3           Arbolder         S 0,05 Piece         Salinless Steel         Included in battery         <	Regular Box		❖	6,00 Piece	Fiberglass	Produced SA	Price estimated	PRT-1101-Box-R	П		0	- \$
Action of Englands         S 35.00 Set         Electronics         Import china         Price estimated         PRT-00046-C5G-L68 & PB-PCB         2           Action Schools         5 0,71 Plece         Electronics         Local shops         PP         PRT-00004-C5G-L64         2           Action Schools         5 0,12 Plece         Electronics         Local shops         PP         PRT-00004-C5G-L64         2           Action Schools         5 0,12 Plece         Aluminium         Produced SA         Raw material PP         PRT-0001-C5G-lectrosteget         3           Action Schools         5 0,12 Plece         Galv Steel         Produced SA         Raw material PP         PRT-0001-C5G-lectrosteget         3           Action Schools         5 0,02 Plece         Galv Steel         Produced SA         Raw material PP         PRT-0002-Bracket PGB         3           Action Schools         5 0,03 Plece         Galv Steel         Produced SA         Raw material PP         PRT-0002-Bracket PGB         3           Action Schools         5 0,03 Plece         Galv Steel         Included in batter         PRT-2002-Bracket PGB         3           Action Schools         5 0,03 Plece         Stainless Steel         Included in batter         PRT-2002-Bracket PGB         7           Action Schools	Large Box		φ.	5,00 Piece	Fiberglass	Produced SA	Price estimated	PRT-2101-Box-L		- \$	H	\$ 5,00
ttc socket         5         0.14 Piece         Electronicis         Local shops         PP         PRT-0004-Csocket         2           clock Hamle         5         0.04 Piece         Electronicis         Local shops         PP         PRT-0003-IEC-F         1           clock Male         5         0.19 Piece         Aluminium         Produced SA         Raw material PP         PRT-0001-ECSSheet         1           et PCB         5         0.03 Piece         Aluminium         Produced SA         Raw material PP         PRT-0001-ECSSheet         1           et PCB         5         0.04 Piece         Galv Steel         Produced SA         Raw material PP         PRT-0002-EnacketCBB         3           y bolder         5         0.08 Piece         Galv Steel         Produced SA         Raw material PP         PRT-0002-EnacketCBB         3           y bolder         5         0.09 Piece         Galv Steel         Produced SA         Raw material PP         PRT-0002-EnacketCBB         3           b bold         5         0.1 Piece         Stainless Steel         Produced SA         Raw material PP         PRT-0002-EnacketBB         3           b bold         5         0.1 Piece         Stainless Steel         Produced SA         Raw material PP <td>PCB (Powerboard + USB)</td> <td></td> <td></td> <td>5,00 Set</td> <td>Electronics</td> <td>Import china</td> <td>Price estimated</td> <td>PRT-0006-PCB-USB &amp; PB-PCB</td> <td>1</td> <td></td> <td>1</td> <td>\$ 35,00</td>	PCB (Powerboard + USB)			5,00 Set	Electronics	Import china	Price estimated	PRT-0006-PCB-USB & PB-PCB	1		1	\$ 35,00
cycle Female         \$ 0.04 Piece         Electronics         Local shops         PP         PRT-0003-IEC-M           cycle Female         \$ 0.12 Piece         Electronics         Local shops         RP material PP         PRT-0003-IEC-M         2           g sheer PCB         \$ 0.02 Piece         Galv Steel         Produced SA         Raw material PP         PRT-000-BracketPCB         3           et PCB         \$ 0.02 Piece         Galv Steel         Produced SA         Raw material PP         PRT-000-BracketBattery         3           dy holder         \$ 0.02 Piece         Galv Steel         Produced SA         Raw material PP         PRT-2002-BracketBattery         3           dy holder         \$ 0.02 Piece         Galv Steel         Produced SA         Raw material PP         PRT-2002-BracketBattery         3           d be fort         \$ 0.02 Piece         Galv Steel         Produced SA         Raw material PP         PRT-2002-BracketBattery         4           Assert Steel         \$ 0.02 Piece         Stainless Steel         Produced SA         Raw material PP         PRT-2002-BracketBattery         4           Be resker         \$ 0.02 Piece         Stainless Steel         Produced SA         Raw material PP         PRT-2002-BracketBattery         4           Be be fort <t< td=""><td>Cigarette socket</td><td></td><td></td><td>0,71 Piece</td><td>Electronics</td><td>Local shops</td><td>ЬР</td><td>PRT-0004-C-Socket</td><td>2</td><td></td><td>3</td><td>\$ 2,13</td></t<>	Cigarette socket			0,71 Piece	Electronics	Local shops	ЬР	PRT-0004-C-Socket	2		3	\$ 2,13
ckiele Male         5         0.19 Piece         Electronics         Local shops         PP         RPT-0003-IEC-M         2           g sheet PCB         5         0.30 Piece         Aluminium         Produced SA         Raw material PP         RPT-0010-PCBS-heet         1           g tPCB         5         0.01 Piece         Aluminium         Local shops         Raw material PP         RPT-0005-BradeteBrBCB         3           vp holder         5         0.00 Piece         Galv Steel         PRT-2002-BradeteBattery         0           vp holder         5         0.05 Piece         Galv Steel         Included in battery         MA3 Nut         1           both         5         0.05 Piece         Galv Steel         Included in battery         MA3 Docs         1           1 Breaker         5         0.05 Piece         Stainless Steel         Included in battery         MW Asher s         2           1 Breaker         5         0.07 Piece         Stainless Steel         Included in battery         MW Asher s         2           2 Countersunk bolt         5         0.04 Piece         Stainless Steel         Included in battery         MW Asher s         2           3 Countersunk bolt         5         0.04 Piece         Stainless Steel	IEC Socket Female			0,04 Piece	Electronics	Local shops	ЬР	PRT-0003-IEC-F	1		1	\$ 0,04
g sheet PGB         5         0.30 Piece         Aluminium         Produced SA         Raw material PP         PRT-1001-PGSsheet         1           et PGB         5         0.01 Piece         Galv Steel         Produced SA         Raw material PP         PRT-2002-BracketPCB         3           ry holder         5         0.01 Piece         Galv Steel         Produced SA         Raw material PP         PRT-2002-BracketPCB         3           ut         5         0.08 Piece         Galv Steel         Produced SA         Raw material PP         PRT-2002-BracketPB atteny         0           ut         1         5         0.08 Piece         Galv Steel         Produced SA         Raw material PP         PRT-2002-BracketBB atteny         0           boht         5         0.09 Piece         Galv Steel         Produced SA         PRT-2002-BracketBB atteny         0           counters unk bolt         5         0.20 Piece         Stainless Steel         Produced SA         PRT-2002-Circitibreaker         1           boht         5         -         -         Stainless Steel         Produced In batteny         MS Assers         0           boht         5         0.01 Piece         Stainless Steel         Produced In batteny         MS Stacers         0 <td>IEC Socket Male</td> <td></td> <td>φ.</td> <td>0,19 Piece</td> <td>Electronics</td> <td>Local shops</td> <td>ЬР</td> <td>PRT-0003-IEC-M</td> <td></td> <td></td> <td>2</td> <td>\$ 0,38</td>	IEC Socket Male		φ.	0,19 Piece	Electronics	Local shops	ЬР	PRT-0003-IEC-M			2	\$ 0,38
EFCREADING         S         0,02 Piece         Galv Steel         Produced SA Produced SA Produced SA Paw material PP PRT-0005-BracketBattery         RTR-0005-BracketBattery         S           ty holder         5         0,03 Piece         Galv Steel         Produced SA Paw material PP PRT-0002-BracketBattery         10           two conditions         5         0,06 Piece         Galv Steel         Produced SA Paw material PP PRT-0002-BracketBattery         10           two conditions         5         0,05 Piece         Galv Steel         Natural PRT-0002-BracketBattery         10           two conditions         5         0,05 Piece         Galv Steel         Natural PRT-0002-BracketBattery         10           two conditions         5         0,02 Piece         Stainless Steel         Natural Natur	Cooling sheet PCB		φ.	0,30 Piece	Aluminium	Produced SA	Raw material PP	PRT-0101-PCBSheet	_		П	\$ 0,30
year ofference of the control of the contro	Bracket PCB			0,02 Piece	Galv Steel	Produced SA	Raw material PP	PRT-0005-BracketPCB			8	90'0
S   0,08   Piece   Galv Steel   Produced SA   Raw material PP   PRT-2002-Bracket Battery   0.00   Piece   Galv Steel   M3 Nut   M6x16   M3 Nut	Rivet			0,01 Piece	Aluminium	Local shops		3,2x8 Blind Rivet			9	\$ 0,03
S   0,00   Piece   Galv Steel   M3 Nut   M1 Spacer 10   M3 Spacer 10   M3 Spacer 10   M4 Spacer 10   M5 Spacer 10   M6 Space	Battery holder			0,08 Piece	Galv Steel	Produced SA	Raw material PP	PRT-2002-BracketBattery		- \$	2	\$ 0,16
S	M3 Nut			0,00 Piece	Galv Steel			M3 Nut			10	\$ 0,03
\$ - 0.02 Piece   Included in battery   M6x16   2   2   2   2   2   2   2   2   2	M3 Spacer 10mm		\$	0,05 Piece	Galv Steel			M3 Spacer 10			4	\$ 0,20
\$ 0,02 Piece	M6x16 bolt		\$		Stainless Steel	-	Included in battery	M6x16			0	- \$
S	M3x20 Countersunk bolt		φ.					M3x20 CS			10	\$ 0,20
Stainless Steel -   Included in battery   M8 Washer s   2	Circuit Breaker		φ.	2,26 Piece				PRT-0001-CircuitBreaker			1	\$ 2,26
\$         Stainless Steel -         Included in battery         M8 Washer s         0           \$         -         Stainless Steel -         Included in battery         M8x20         0           \$ 0,02         Piece         Stainless Steel -         Included in battery         M8x20         0           \$ 0,02         Piece         Stainless Steel -         M8 Spacer 3         7           \$ 0,04         Piece         Galv Steel -         M8 Spacer 3         7           \$ 0,04         Piece -         Galv Steel -         M8 Spacer 3         7           \$ 0,01         Piece -         Galv Steel -         M8 Ring Terminal B         15           \$ 0,01         Piece -         M8 Ring Terminal B         2           \$ 0,01         Piece -         M8 Ring Terminal B         7           \$ 0,01         Piece -         Go.5 End Cap         7           \$ 0,01         Piece -         Go.5 End Cap         7           \$ 0,02         Piece -         Go.5 End Cap         7           \$ 0,02         Piece -         Go.5 End Cap         7	M6 spring washer		\$		Stainless Steel	-	Included in battery	M6 Washer s			0	- \$
\$ 0,02         Piece         Stainless Steel         Included in battery         M8x20         0           \$ 0,02         Piece         Stainless Steel         M3 Spacer 3         7           \$ 0,03         Piece         Galv Steel         M5x16 CS         2           \$ 0,04         Piece         Galv Steel         6.3 Faston         15           \$ 0,01         Piece         M8 Ring Terminal B         15           \$ 0,01         Piece         M8 Ring Terminal B         2           \$ 0,01         Piece         20.5 End Cap         7           \$ 0,10         Piece	M8 spring washer		\$		Stainless Steel	-	Included in battery	M8 Washer s			2	- \$
\$ 0,02   Piece   Stainless Steel   3x12 Torx-st   7   7   7   7   7   7   7   7   7	M8x20 bolt		\$	-	Stainless Steel	1	Included in battery	M8x20		- \$	2	- \$
\$ 0,03 Piece   Galv Steel   M5x16 CS   M5x16 CS   2   2   2   2   2   2   2   2   2	3x12 Self tapping Torx		❖		Stainless Steel			3x12 Torx-st			7	\$ 0,14
\$ 0,04 Piece   Galv Steel   6.3 Faston   15   6.0 Table   15   6.3 Faston   15   6	M3 Spacer 3mm							M3 Spacer 3			7	\$ 0,21
\$ 0,01 Piece   6.3 Faston B   15     \$ 0,01 Piece   6.3 Faston B   15     \$ 0,01 Piece   MR Ring Terminal B   2     \$ 0,01 Piece   MR Ring Terminal B   2     \$ 0,01 Piece   2     \$ 0,10 Piece   3     \$ 0,10 Piece   3     \$ 0,20 Piece   3	M5x16 Countersunk bolt		❖		Galv Steel			M5x16 CS			4	\$ 0,16
\$ 0,01   Piece   6.3 Faston B   15	Faston 6.3 clip (red)		ᡐ					6.3 Faston			17	\$ 0,09
\$ 0,01 Piece   M8 Ring Terminal B   2   2   2   2   2   2   2   2   2	Faston 6.3 clip (black)		φ.					6.3 Faston B			17	\$ 0,09
\$ 0,01   Piece   MM8 Ring Terminal B   2	Ring terminal M8 (red)		❖					M8 Ring Terminal			2	\$ 0,02
\$ 0,10 Piece 20.5 End Cap 1 \$ 0,10 Piece - 7 \$ 0,10 Piece - 7 \$ 0,20 Piece - 1	Ring terminal M8 (black)		❖					M8 Ring Terminal B			2	\$ 0,02
\$ 0,10 Piece - 7  \$ 0,10 Piece - 7  \$ 0,20 Piece - 1  \$ 0,20 Piece - 1  Take Latent hove:	Closing lid software&configuartion access		φ.	0,10 Piece				20.5 End Cap			1	\$ 0,10
\$ 0,10 Piece - 7 \$ 0,20 Piece - 1 \$ 0,20 Piece - 1  Take Locke Battery boxes	Cable red 20cm		❖	0,10 Piece				-			8	\$ 0,80
m \$ 0,20 Piece - 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Cable black 20cm		❖	0,10 Piece							8	\$ 0,80
\$ 0,20 Piece	Cable red 40cm		❖	0,20 Piece					Н		Н	\$ 0,20
	Cable black 40cm		৵	0,20 Piece				-	1	\$ 0,20	1	0,20
•										egular SHS		Large SHS:
Α,								Total costs Battery boxes:		\$ 117,44		144,75

Description	Price (USD)	Details
Solar Panel 70W	\$ 33,8800	JCN
Solar Panel 130W	\$ 60,0600	JCN
Battery 55Ah	\$ 69,0000	Ritar RA series
Battery 100Ah	\$ 96,1400	Ritar RA series
Battery box Regular	\$ 4,0000	Produced in-House
Battery box Large	\$ 6,0000	Produced in-House
PCB-Display	\$ 10,0000	
PCB-V3	\$ 35,0000	
Solar Cable 130W	\$ 17,1700	Produced in-House
Solar Cable 70W	\$ 10,2700	Imported
LED-9W	\$ 3,9700	
LED-5W	\$ 2,2500	
Lamp Holder	\$ 0,3000	

Description	Price (Riel)	Price (USD)	Per	Material	Bought in
Tube 40 x 20mm		\$ 0,9167	meter	Galvanized steel	Local steel shops
Tube 20 x 20mm		\$ 0,6667	meter	Galvanized steel	Local steel shops
Tube ø42mm		\$ 0,6667	meter	Galvanized steel	Local steel shops
Cable 4,5mm	1.500€	\$ 0,3750	meter	Galvanized steel	Russian market area
Cable Lug HEX10-8		\$ 0,1500	piece	Tin-copper	PP General Electrical Shop
Butt-Connector 16HEX 43mm		\$ 0,3000	piece	Tin-copper	PP General Electrical Shop
Cable Tensioner no.6		\$ 0,5000	piece	Galvanized steel	Russian market area
Threaded rod M6		\$ 1,0000	meter	Galvanized steel	Russian market area
Bolt M6x120		\$ 0,0300	piece	Galvanized steel	Russian market area
Bolt M6x25mm Flathead		\$ 0,0100	piece	Galvanized steel	Russian market area
Bolt M6x50mm		\$ 0,0200	piece	Galvanized steel	Russian market area
Rivet 3,2x8mm		\$ 0,0050	piece	Galvanized steel	Russian market area
Washer M6		\$ 0,0050	piece	Galvanized steel	Russian market area
Nut M6		\$ 0,0100	piece	Galvanized steel	Russian market area
Steel Sheet 1,5mm		\$ 6,6667	square meter	Galvanized steel	Local steel shops
Bolt M8x50		\$ 0,0300	piece	Galvanized steel	Russian market area
Nut M8		\$ 0,0200	piece	Galvanized steel	Russian market area
Washer M8		\$ 0,0100	piece	Galvanized steel	Russian market area
Woodscrew M8x80		\$ 0,0300	piece	Galvanized steel	Russian market area
Tube 30 x 30mm		\$ 0,7500	meter	Galvanized steel	Local steel shops

Description	Material	Length (m), Surface (m x m) or Amount	Amount in assembly	Price (USD)			
Vertical support	Tube 30 x 30mm	0,585	2	\$ 0,88	\$	3,58 Profiles	iles
Horizontal support	Tube 30 x 30mm	0,95	2	\$ 1,43	3		
Mounting pole	Tube ø42mm	0,95	1	\$ 0,63	3		
Clamp pole	Steel Sheet 1,5mm	0,008	2	\$ 0,11	1		
Bracket pole	Steel Sheet 1,5mm	0,0105	2	\$ 0,14	4		
Rubber cover	Recycled car cover	1	1	\$ 0,40	0		
Cable ASSEMBLY	Cable 4,5mm	0,4	4	9′0 \$	\$ 09'0	2,90 Cabl	2,90 Cable structure
	Cable Lug HEX10-8	2	4	\$ 1,20	0		
Cable tension ASSEMBLY	Cable Tensioner no.6	2	1	\$ 1,00	0		
	Threaded rod M6	0,1	1	\$ 0,10	0		
Fasteners Base	Bolt M6x120	1	1	0,0 \$	0,03 \$	0,68 Fasteners	teners
	Bolt M6x50mm	1	8	\$ 0,16	9		
	Washer M6	1	24	\$ 0,12	2		
	Nut M6	1	6	\$ 0,09	6		
Fasteners Clamps	Bolt M6x50mm	1	4	\$ 0,08	∞		
	Nut M6	1	4	\$ 0,04	4		
	Washer M6	1	∞	\$ 0,04	4		
	Woodscrew M8x80	1	4	\$ 0,12	2		
			Total Mounting Pole:	\$ 7,16	9		

Description	Material	Length (m), Surface (m x m) or Amount	Amount in assembly	Price (USD)		
Arm	Tube 30 x 30mm	77.0	1	\$ 0,58	\$	0,74 Profiles
Solar Support Clamp	Steel Sheet 1,5mm	0,008	3	\$ 0,16		
Fasteners	Rivet 3,2x8mm	1	9	\$ 0,03	٠,	0,26 Fasteners
	Bolt M6x25mm Flathead	1	8	\$ 0,08		
	Washer M6	1	8	\$ 0,04		
	Bolt M6x120	1	1	\$ 0,03		
	Nut M6	1	8	\$ 0,08		
Solar Panel	Solar Panel 70W	1	-	\$ 33,88 \$		44,35 Panel regular
Solar panel Connection clamp	Steel Sheet 1,5mm	0,0075	4	\$ 0,20		
cable	Solar Cable 70W	1	1	\$ 10,27		
Solar Panel	Solar Panel 130W	1	1	\$ 90,09 \$		77,23 Panel large
cable	Solar Cable 130W	1	1	\$ 17,17		
			Extension:	\$ 1,00		
			Total Regular Extension:	\$ 46,15		
			Total Large Extension:	\$ 79,23		

រីសិនហ្្វាន់ 2,00% តំលាំ SHS 70W CORE 400 \$ បង់រំល**ោះ២ឆ**ុនាំ 36 (ខ**ែ**)

	ប្ទាក់ដទើមនៅជំពាក់	ប្ទាក់ដទើមត្នូវបង	ការប∙្រាក់	ប្រាក់ស៊ុបដលែត្រូវបង់
ខទ្វែ1	400,00	11,11	8,00	19,11
ខទីវិ2	388,89	11,11	7,78	18,89
ខទីវិ3	377,78	11,11	7,56	18,67
ខទ្វែ4	366,67	11,11	7,33	18,44
ខទីៃ5	355,56	11,11	7,11	18,22
ខទីទី6	344,44	11,11	6,89	18,00
ខទីែ7	333,33	11,11	6,67	17,78
ខទ្វែន	322,22	11,11	6,44	17,56
ខទីទី១	311,11	11,11	6,22	17,33
ខទីែ10	300,00	11,11	6,00	17,11
ខទី11	288,89	11,11	5,78	16,89
ខទីវ12	277,78	11,11	5,56	16,67
ខទីវ3	266,67	11,11	5,33	16,44
ខទី14	255,56	11,11	5,11	16,22
ខទ្វែ15	244,44	11,11	4,89	16,00
ខទី16	233,33	11,11	4,67	15,78
ខទ្វែ17	222,22	11,11	4,44	15,56
ខទីវ8	211,11	11,11	4,22	15,33
ខទីែ19	200,00	11,11	4,00	15,11
ខទីែ20	188,89	11,11	3,78	14,89
ខទី21	177,78	11,11	3,56	14,67
ខទី22	166,67	11,11	3,33	14,44
ខទី23	155,56	11,11	3,11	14,22
ខទី24	144,44	11,11	2,89	14,00
ខទី25	133,33	11,11	2,67	13,78
ខទី26	122,22	11,11	2,44	13,56
ខទី27	111,11	11,11	2,22	13,33
ខទី28	100,00	11,11	2,00	13,11
ខទី29	88,89	11,11	1,78	12,89
ខទី30	77,78	11,11	1,56	12,67
ខទី31	66,67	11,11	1,33	12,44
ខទី32	55,56	11,11	1,11	12,22
ខទ្វែ33	44,44	11,11	0,89	12,00
ខទី34	33,33	11,11	0,67	11,78
ខទ្វែ35	22,22	11,11	0,44	11,56
ខទែី36	11,11	11,11	0,22	11,33

15,22

សល	400.00	148.00	548.00

 វីសិនហ្វាន់
 2,00%

 ឥលិ SHS 70W CORE
 350 \$

 បង់រំល**ោះ២ឆ**្នាំ
 36 (ខ្ស)

	ប្ទាក់ដទើមនៅជំពាក់	ប្រាក់ដទើមត្បូវបង់	ការប្រាក់	ប្រាក់ស៊ុបដលែត្រូវបង់
ខទី1	350,00	9,72	7,00	16,72
ខទី2	340,28	9,72	6,81	16,53
ខទ្វែ3	330,56	9,72	6,61	16,33
ខទ្វែ4	320,83	9,72	6,42	16,14
ខទី5	311,11	9,72	6,22	15,94
ខទីែ6	301,39	9,72	6,03	15,75
ខទី7	291,67	9,72	5,83	15,56
ខទីន	281,94	9,72	5,64	15,36
ខទីៃ9	272,22	9,72	5,44	15,17
ខទីែ10	262,50	9,72	5,25	14,97
ខទី11	252,78	9,72	5,06	14,78
ខទី12	243,06	9,72	4,86	14,58
ខទី13	233,33	9,72	4,67	14,39
ខទ្វី14	223,61	9,72	4,47	14,19
ยเ้รี่ 15	213,89	9,72	4,28	14,00
ខទី16	204,17	9,72	4,08	13,81
ខទី17	194,44	9,72	3,89	13,61
ខទីែ18	184,72	9,72	3,69	13,42
ខទី19	175,00	9,72	3,50	13,22
ខទី20	165,28	9,72	3,31	13,03
ខទី21	155,56	9,72	3,11	12,83
ខទ្វី22	145,83	9,72	2,92	12,64
ខទ្វី23	136,11	9,72	2,72	12,44
ខទ្វី24	126,39	9,72	2,53	12,25
ខទី25	116,67	9,72	2,33	12,06
ខទី26	106,94	9,72	2,14	11,86
ខទី27	97,22	9,72	1,94	11,67
ខទីវិ28	87,50	9,72	1,75	11,47
ខទីវិ29	77,78	9,72	1,56	11,28
ខទី30	68,06	9,72	1,36	11,08
ខទ្វែ31	58,33	9,72	1,17	10,89
ខទ្វែ32	48,61	9,72	0,97	10,69
ខទ្វែ33	38,89	9,72	0,78	10,50
ខទ្វែ34	29,17	9,72	0,58	10,31
ខទ្វែ35	19,44	9,72	0,39	10,11
ខទ្វែ36	9,72	9,72	0,19	9,92

13,32

សុរាប 350,00 129,50 479,50

រីសិនហ្វាន់ 2,00% តំលាំ SHS 130W CORE 530 \$ បង់រំល**ោះ២ឆ**្នាំ 36 (ខ្

	ប្ទាក់ដទើមនៅជំពាក់	ប <b>្</b> រាក់ដ <b>ើមត</b> ្សវបង់	ការប <b>្</b> រាក់	ប្រាក់សរុបដលែតៈរូវបង់
ខទី1	530,00	14,72	10,60	25,32
ខទី2	515,28	14,72	10,31	25,03
ខទី3	500,56	14,72	10,01	24,73
ខទ្ទី4	485,83	14,72	9,72	24,44
ខទី5	471,11	14,72	9,42	24,14
ខទីែ6	456,39	14,72	9,13	23,85
ខទី7	441,67	14,72	8,83	23,56
ខទ្វែន	426,94	14,72	8,54	23,26
ខទីៃ9	412,22	14,72	8,24	22,97
ខទីែ10	397,50	14,72	7,95	22,67
ខទី11	382,78	14,72	7,66	22,38
ខទី12	368,06	14,72	7,36	22,08
ខទី13	353,33	14,72	7,07	21,79
ខទី14	338,61	14,72	6,77	21,49
ខទីែ15	323,89	14,72	6,48	21,20
ខទ៊ែ16	309,17	14,72	6,18	20,91
ខទី17	294,44	14,72	5,89	20,61
ខទ្វែ18	279,72	14,72	5,59	20,32
ខទ៊ី19	265,00	14,72	5,30	20,02
ខទីែ20	250,28	14,72	5,01	19,73
ខទី21	235,56	14,72	4,71	19,43
ខទីែ22	220,83	14,72	4,42	19,14
ខទី23	206,11	14,72	4,12	18,84
ខទ្វី24	191,39	14,72	3,83	18,55
ยใชี25	176,67	14,72	3,53	18,26
ខទី26	161,94	14,72	3,24	17,96
ខទី27	147,22	14,72	2,94	17,67
ខទី28	132,50	14,72	2,65	17,37
ខទី29	117,78	14,72	2,36	17,08
ខទ្វែ30	103,06	14,72	2,06	16,78
ខទ្វែ31	88,33	14,72	1,77	16,49
ខទ្វែ32	73,61	14,72	1,47	16,19
ខទ្វែ33	58,89	14,72	1,18	15,90
ខទ្វែ34	44,17	14,72	0,88	15,61
ខទ្វែ35	29,44	14,72	0,59	15,31
ខទែី36	14,72	14,72	0,29	15,02

សុរាប 530,00 196,10 726,10

20,17

វីសិនហ្វាន់ 2,00% តំលរំ SHS 130W EXP បង់រំល**ោះ២ឆ**ុនាំ 480 \$ 36 (ខវែ)

	ប្ទាាក់ដទើមនៅជំពាក់	ប <b>្</b> រាក់ដ <b>ើ</b> មត <b>្</b> រវបង	ការប <b>្</b> រាក់	ប្រាក់សរុបដលែត្លូវបង
ខទីែ1	480,00	13,33	9,60	22,93
ខទីវិ2	466,67	13,33	9,33	22,67
ខទីវិ3	453,33	13,33	9,07	22,40
ខទ្ទៃី4	440,00	13,33	8,80	22,13
ខទីទី5	426,67	13,33	8,53	21,87
ខទីៃ6	413,33	13,33	8,27	21,60
ខទី7	400,00	13,33	8,00	21,33
ខទីន	386,67	13,33	7,73	21,07
ខទីទី១	373,33	13,33	7,47	20,80
ខទីែ10	360,00	13,33	7,20	20,53
ខទី11	346,67	13,33	6,93	20,27
ยเ์รี12	333,33	13,33	6,67	20,00
ខទី13	320,00	13,33	6,40	19,73
ខទី14	306,67	13,33	6,13	19,47
ខទីែ15	293,33	13,33	5,87	19,20
ខទី16	280,00	13,33	5,60	18,93
ខទីវ	266,67	13,33	5,33	18,67
<b>ย</b> เรี18	253,33	13,33	5,07	18,40
ខទី19	240,00	13,33	4,80	18,13
ខទី20	226,67	13,33	4,53	17,87
ខទី21	213,33	13,33	4,27	17,60
ខទី22	200,00	13,33	4,00	17,33
ខទី23	186,67	13,33	3,73	17,07
ខទី24	173,33	13,33	3,47	16,80
ខទី25	160,00	13,33	3,20	16,53
ខទី26	146,67	13,33	2,93	16,27
ខទី27	133,33	13,33	2,67	16,00
ខទី28	120,00	13,33	2,40	15,73
ខទី29	106,67	13,33	2,13	15,47
ខទី30	93,33	13,33	1,87	15,20
ខទី31	80,00	13,33	1,60	14,93
ខទី32	66,67	13,33	1,33	14,67
ខទ្វែ33	53,33	13,33	1,07	14,40
ខទ្វែ34	40,00	13,33	0,80	14,13
ខទ្វែ35	26,67	13,33	0,53	13,87
ខទី36	13,33	13,33	0,27	13,60

18,27

480,00 177,60 657,60 ស៊ុប

