aquatech
Solar Technologies Pty Ltd

RAPID/X6

DESIGN DOCUMENT

The RAPID/X6 product development started with a simple question…

If Electric and Gas HWS are phased out, what would the replacement alternative be?

With this question posed, we realised that our DYNAMIC/X8 model had limitations to be a genuine alternative to traditional Electric & Gas HWS. So we set about designing a heat pump that would meet the challenge head-on.

- It needed to be smaller & compact so it could be installed in a like for like position.
- It needed to be easy to transport & manoeuvre so that a single tradesperson could handle it.
- It needed to deliver comparable heating capacity as an Electric HWS across all climates.
- It required flexibility; we wanted to create a "SINGLE MODEL" that could serve a wide range of households whether their hot water demand was small, medium, or large.
- It needed to have cost-competitiveness, so that barrier to entry and payback timeframes made economic sense even without government rebates & financial incentives.

With over a decade of designing, manufacturing and distributing domestic heat pumps, we knew we had the knowledge and experience to deliver a product that met these requirements.

We began by undertaking a total review of our DYNAMIC/X8 to see what core components & design elements we would need to retain to ensure that the new system was as durable & efficient as our flagship model.

We then explored our back catalogue, which included both 150L & 170L models. We wanted to see what could be learnt from our previous attempts at delivering a compact integrated heat pump. We analysed how these models had performed in real-world environments, their ability to provide hot water loads, their design strengths as well as their limitations.

With this knowledge at hand, we spent over a year designing testing and certifying. The result was a new model and the realisation that to compete directly against Electric & Gas HWS; we would need to re-invent our entire approach to marketing and distributing domestic heat pumps within the Australian market.

These efforts have delivered both a new model and a new trade exclusive brand. We are therefore very proud to introduce the RAPID/X6, part of the Aquatech Professional Range.

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SECTION 1: RAPID/X6 CORE COMPONENTS

BUILDING OFF THE DYNAMIC/X8

In 2018 Aquatech Solar Technologies undertook a complete design upgrade to our flagship DYNAMIC/X8 model. We reinvented this model to ensure that it is the best system we could deliver today and in the future.

- We adopted a new R290 refrigerant that is greener and more efficient.

- We introduced a new storage tank to deliver a more durable and consistent product, switching from stainless to vitreous enamel materials.

- We introduced hybrid technology, pairing the heat pump with an intelligently controlled element to provide heating versatility and backup reliability.

- We introduced a new external casing that eliminated plastic components, significantly improving system durability in the harsh Australian environment.

The success of the revamped DYNAMIC/X8 model resulted in quantitive improvements to efficiency and heating performance and customer feedback and engagement. It delivered a solid platform from which to build the RAPID/X6 design.

We determined that the RAPID/X6 should incorporate the core components and design features, that make the DYNAMIC/X8 a versatile and competent heat pump. By building off the DYNAMIC/X8 platform, we could be confident that the RAPID/X6 would meet our expectations in terms of performance and durability.

SHARED CORE COMPONENTS

Once the decision was made that the new RAPID/X6 would be based on the DYNAMIC/X8 platform, we needed to identify the core components shared between both models.

Apart from incorporating the DYNAMIC/X8 all-new metal casing, the RAPID/X6 storage tank is constructed from the same 2.5mm thick sheeting and coated with an X class enamel, industry-leading specifications. The RAPID/X6 and DYNAMIC/X8 also share identical refrigeration circuits and electric heating elements. The decision to include these core components across both models ensures we can be confident that RAPID/X6 is constructed to our highest possible standard, with the heating capacity to meet an extensive hot water load profile.

	RAPID/X6	DYNAMIC/X8
		

REFRIGERATION

Refrigerant	R290	R290
Charge (g)	350	350
Rated Power input (W)	735	735
Max Power input (W)	900	900
Capacitor Rating (uf)	25	25
Heat Exchanger Type	Micro-channel	Micro-channel
Heat Exchanger Height (mm)	715	715
Heat Exchanger Width (mm)	1535	1535
Evaporator Dimensions	420*350*93/3 rows	420*350*93/3 rows
Airflow Rate (m3/s)	550	550
Expansion Control	Electronic	Electronic
Defrost Control	4-way reverse valve	4-way reverse valve
Max Ambient Temperature (°C)	43	43
Min Ambient Temperature (°C)	-5	-5

ELECTRIC ELEMENT

Element Rating (W)	1800	1800
Element Material	Incoloy	Incoloy
Element Connection	Flange	Flange
Element Thermostat	Robertshaw	Robertshaw

STOREAGE TANK

Material	Carbon Steel	Carbon Steel
Enamel Rating*	X	X
Wall Thickness (mm)	2.5	2.5
Dome Thickness (mm)	3	3
PTR Rating (kPa)	850	850
Dome Construction*	Concave/Convex	Concave/Convex
Magnesium Anode	2	2
Impressed Current Anode	G3/4 male/Φ3*355	G3/4 male/Φ3*355

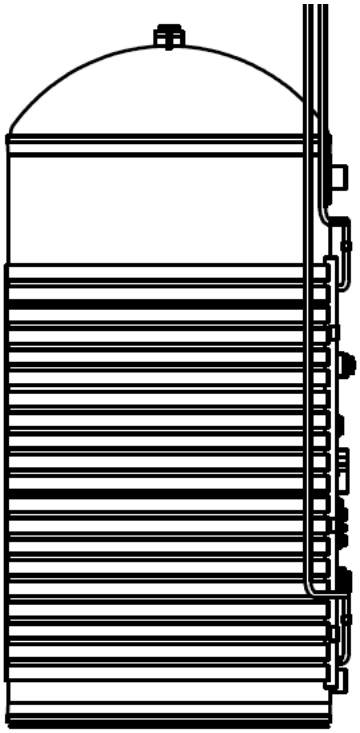
SELECTION PROCESS: DIMENSIONS & TANK SIZE.

Critical parameters of the RAPID/X6 specifications were determined by our choice to share core components with the DYNAMIC/X8.

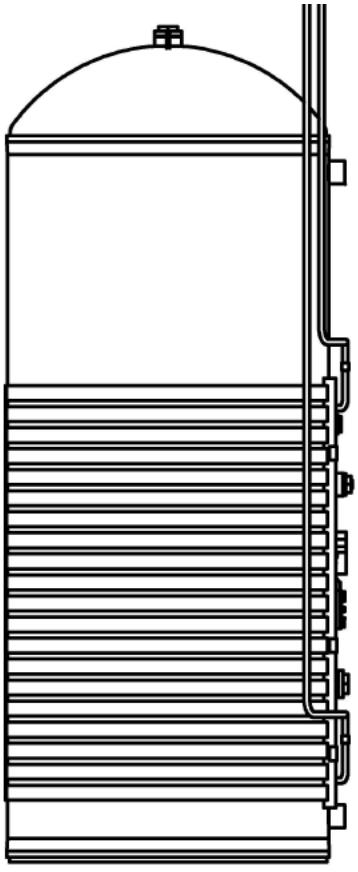
- The systems both share the same tank construction, which results in a diameter of 620mm.

- The systems both share the same micro-channel heat exchanger. This meant the height of the RAPID/X6 internal tank would need to be a minimum1050mm any shorter and the heat exchanger wouldn't fit.

RAPID/X6



DYNAMIC/X8



The above images of the internal tank show how the same micro-channel heat exchanger is positioned on each model. If the RAPID/X6 inner tank were shorter than 1050mm, there would not have been enough room between the top of the heat exchanger and the hot water & ptr outlets. At 1050mm, the minimum storage volume of the system would be 179L.

Once we had determined the minimum specifications based on shared components, we then focused on design factors that we wanted the new RAPID/X6 model to address.

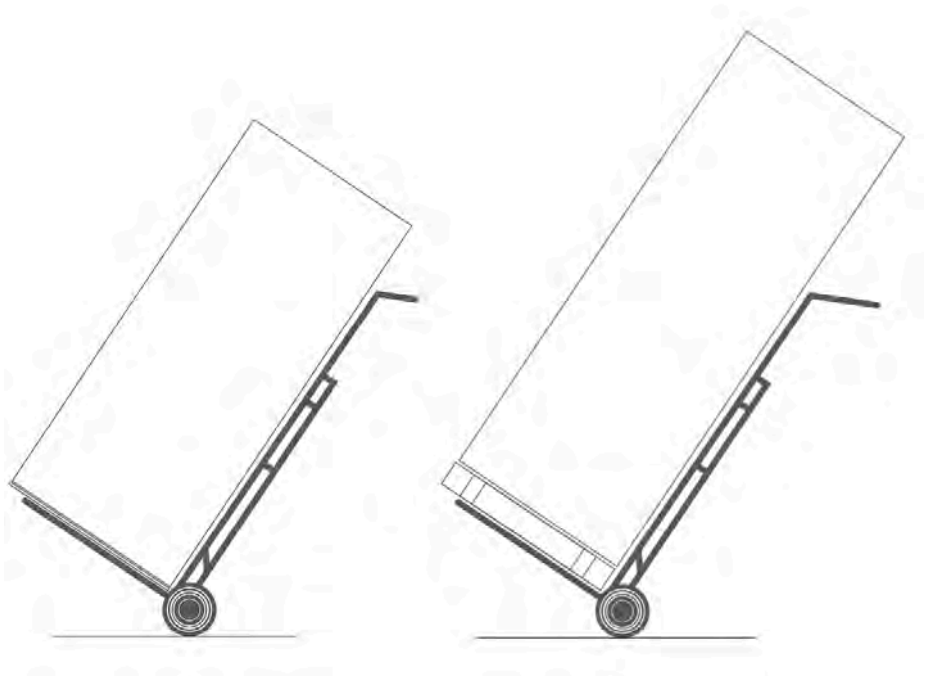
1. *The system needed to be more compact and lighter than the DYNAMIC/X8 to be easily handled and installed by a single tradesperson.*

Compared to other integrated heat pumps, the DYNAMIC/X8 packed dimensions are not excessive. However, these systems' height/bulk/weight still require two persons to handle safely and transport the system for installation.

The actual system height of the RAPID/X6 is only 220mm shorter than the DYNAMIC/X8 based on the final storage tank being 210L. We felt that this height difference was not enough to reduce the system height for transport and handling. So a new packaging system was developed for the RAPID/X6 that eliminated the bulky pallet, making it shorter and more stable.

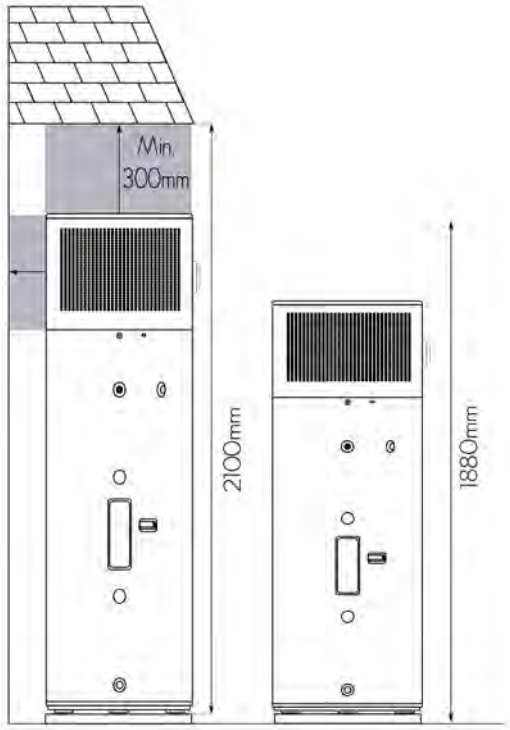
The packed dimensions of the RAPID/X6 are 20% shorter and lighter than the DYNAMIC/X8. The real-world impact of these changes is significant, as they lower the centre of gravity and bring the total height below an average man. This makes the system much easier to transport on a standard trolley and can easily be handled by a single person on site.

COMPARISON OF THE RAPID/X6 & DYNAMIC/X8 TRANSPORTED BY TROLLEY



2. *The system needed to be shorter than the DYNAMIC/X8 to be installed in a wider variety of locations, where the height of the DYNAMIC/X8 has been a limiting factor.*

The DYNAMIC/X8 requires a total install height of 2100mm to accommodate both the system and clearance above to allow for airflow and access for servicing. This full height can create limitations, mainly if installed at a property with low external eves. By comparison, the total install height required for the RAPID/X6 is 220mm shorter at 1880mm. This makes the system more versatile in the locations it can be installed.



3. *The system should have a similar footprint to a standard 250L electric hot water system to compete in the replacement market.*

To accommodate the replacement market where systems are typically installed in a like for like location. It was essential to ensure that both the height and diameter of the RAPID/X6 was comparable to the industry standard for an electric 250L. Comparing the RAPID/X6 to four leading providers, we have achieved similar dimensions within a 10% margin.

RAPID/X6 DIMENSION VS 250L ELECTRIC WATER HEATERS

	DUX	RHEEM	RINNAI	BOSCH	RAPID/X6
Height	1445mm	1395mm	1477mm	1407mm	1580mm
Diameter	620mm	640mm	605mm	610mm	620mm

4. *The system should have enough storage capacity to meet a large load hot water draw profile.*

To compete directly against Electric & Gas hot water systems, we need the RAPID/X6 to be a "*Single Model*" solution to serve many homes. This was important because creating a single model option would reduce the system's price by maximising production and stock holding efficiencies. We would also simplify the decision-making process for potential owners and our trace customers marketing the system.

As a benchmark to determine the RAPID/X6 ability to meet homes' hot water needs, we used the Hot Water Profiles as determined in *AS/NZS 4234:2008 Heat Water Systems*. This standard is used as part of the process when determining a system's STC rating. However, for STCs, heat pumps are only ever tested to show they meet the hot water delivery for a medium load, which translates to a typical four-person home. We wanted to ensure that the RAPID/X6 had the storage and capacity to exceed the minimum requirements and meet a large load defined by *AS/NZS 4234:2008*. By meeting a large load, we could be confident the system would be suitable to install in many homes and handle the daily demand cycle of up to six residents.

When testing and modelling variations of tank volumes, we determined the system should have a minimum of 190L of storage capacity. We, therefore, set this value as the minimum storage rating for the RAPID/X6 at 190L. The internal system tank would be 1100mm.

5. *The system storage tank should be large enough to limit potential customer concerns based on the litre rating.*

Even though we had tested the RAPID/X6 and were confident that the system would meet a large load capacity with a 190L storage tank, we were also aware that potential purchasers typically focus on how many litres of stored hot water systems have to determine suitability for their home.

Previous experience marketing our 150L & 170L models showed us that these volumes were often seen as being too small to meet potential customers' needs. Based on these experiences, we wanted to ensure that the RAPID/X6 storage tank was significantly larger than these past models.

We also examined the most significant sales segment for electric hot water systems, models with 160L or 250L rated storage tanks. A 250L tank would have pushed the size of the RAPID/X6 past the limits we believed are necessary to meet our other objectives of easy handling and installation.

We also wanted the RAPID/X6 to have enough difference when compared to the DYNAMIC/X8 specifications for each model to stand independently of each other. We concluded that a storage reduction of approximately 50L between the models would add value to the DYNAMIC/X8 without negatively impacting the RAPID/X6 marketing appeal.

SUMMARY OF DESIGN PROCESS

The final production specifications of the RAPID/X6 were carefully selected to ensure that the system would meet the design challenge we had set ourselves in creating an integrated heat pump that could function as a genuine alternative to Gas & Electric Hot Water Systems.

In the end, we were able to create a specification set that allowed us to deliver a total 210L of storage capacity while still ensuring the final system height & diameter was within 10% of a 250L electric hot water system.

STOREAGE	
Tank Volume	210L
Tank Delivery	206L
PACKED DIMENSIONS	
Height	1620mm
Width	700mm
Depth	700mm
Weight	112Kg
SYSTEM DIMENSIONS	
Height	1580mm
Width	620mm
Depth	620mm
Weight	108Kg

SECTION 3: RAPID/X6 HOT WATER DELIVERY CAPACITY

How the RAPID/X6 can meet a home's hot water demand is based on three primary factors

1. The systems recovery trigger point
2. The systems heating capacity
3. The systems storage capacity

RECOVERY TRIGGER POINT

The RAPID/X6 has been specifically designed and independently tested to meet a Large Load Delivery per standard AS/NZS 4234:2008. This means the RAPID/X6 should be able to meet the needs of a six-person home under normal operating modes if allowed to recover/ reheat as needed.

To meet a home's hot water demand, additional storage does not necessarily translate to more hot water on demand. This is because a heat pump needs to be triggered to recover the hot water used by the home. How a heating cycle is activated, is often more important than heating capacity and storage volume in meeting a hot water load.

As with most systems our heat pumps are triggered to recover based on the storage tank's water temperature sensor. When hot water is used in the home, it is drawn off from the top of the tank and replaced by cold water coming into the bottom of the tank. When this cold water reaches the sensor, the temperature drops and the heat pump will be triggered to re-heat.

"Due to density differences, cold water and hot water do not easily mix. So even though the sensor may be covered by cold water and reading much lower than the system set-point temperature. The water above the sensor will always be much hotter; this is known as tank stratification."

To meet legionella safety standards, a heat pump set temperature must be 60°C, and the tank sensor can not have less than 45% of the total stored volume above the tank sensor. Due to tank stratification, this means that at least 45% of the stored volume is heated to 60°C every heating cycle.

Some manufacturers will use a lower set temperature of 55°C and then heat the whole tank weekly using an element to 70°C. This also meets legionella safety standards but uses more energy and means the tank has less available hot water the majority of the time.

If the sensor is positioned so that more than 45% of the stored volume above, less hot water will need to be drawn off to trigger heating recovery. This can have a significant impact on the ability of the system to meet a home's demand, as, under these conditions, the system is recovering more often and is more likely to have a full tank of hot water available.

The RAPID/X6 sensor is positioned lower in the storage tank relevant to the DYNAMIC/X8. This means that although the DYNAMIC/X8 has 50L additional storage, both systems have the same volume of water above the sensor. The result is that the RAPID/X6 will recover more frequently and will likely **have a total of 210L of hot water available during the day.** In comparison, the DYNAMIC/X8 will only begin reheating when a larger volume of hot water is drawn off and is more likely to have less hot water available at any given time.

COMPARING THE VOLUMES ABOVE & BELOW TANK SENSOR

RAPID/X6

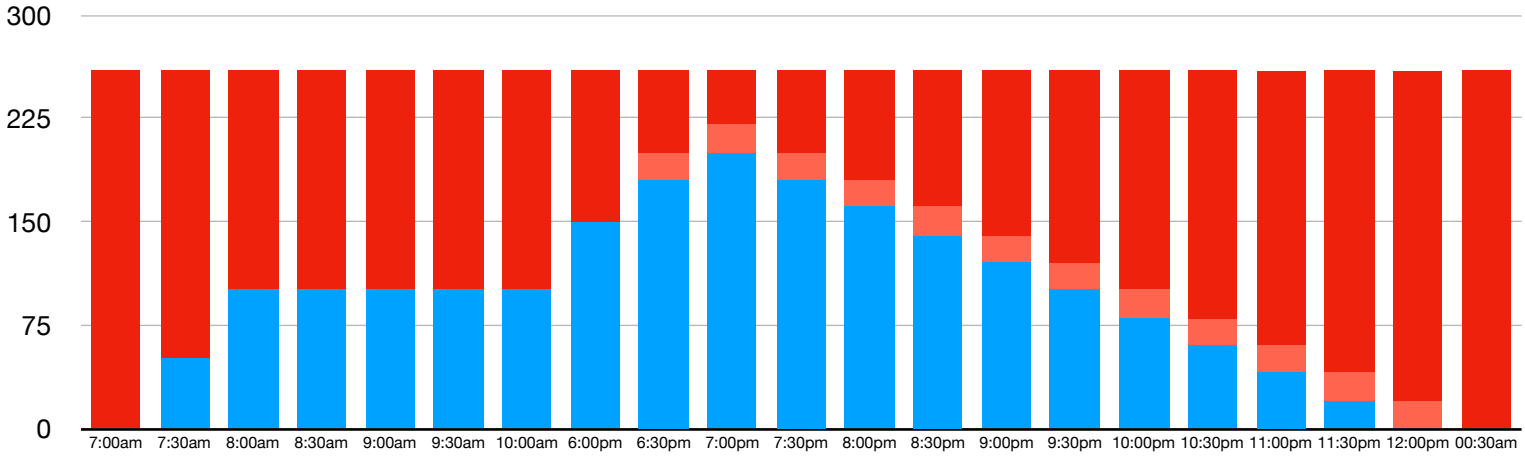
DYNAMIC/X8

VOLUMES		
Tank Volume	213L	262L
Volume above sensor	122L	122L
Volume below sensor	88L	138L

SENSOR POSITION IMPACT ON TANK STORAGE ACROSS 24 HOURS

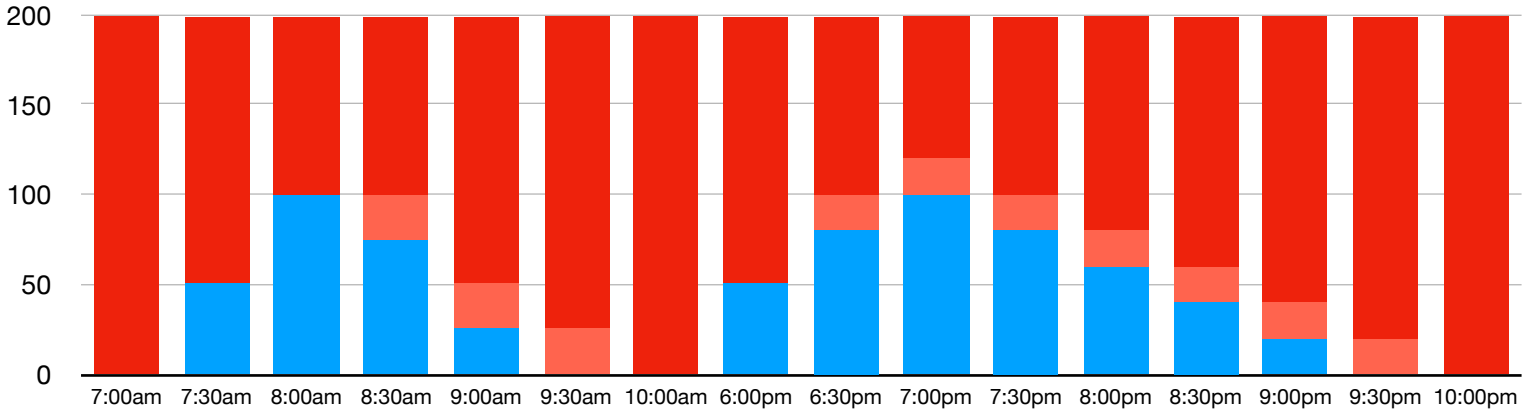
The following modelling graphs illustrate how the sensor position impacts the amount of available hot water. They show the comparison between the stored hot water in the tank (highlighted in red) and cold water (highlighted in blue) over a 24 hour period where 250L of hot water is drawn off based on *AS/NZS 4234:2008* usage patterns.

DYNAMIC/X8 WITH 250L DRAWOFF OVER 24 HOURS



The DYNAMIC/X8 morning draw off is not large enough to cause the sensor to temperature to drop below the 55°C reheat trigger. The system does not recover and reheat the cold water that has entered in the morning. At 6:00 pm, when more hot water is being drawn off, the tank is stratified with 160L of hot water and 100L of cold water.

RAPID/X6 WITH 250L DRAWOFF OVER 24 HOURS



The RAPID/X6 needs a much lower volume of hot water to be drawn off to trigger the system to reheat. After the morning usage, the system begins reheating, and by 6:00 pm, when the second draw begins, the tank has a full tank of hot water.

SUMMARY OF RECOVERY TRIGGER POINT

- The RAPID/X6 tank temperature sensor is lower down closer to the cold water inlet. This means less hot water is needed to be drawn off to trigger recovery.

- The RAPID/X6 will typically have more available hot water in the storage tank if household hot water usage occurs in the morning and evening.

- The RAPID/X6 smaller tank does mean that it will need to recover more frequently and may need a larger heating window if owners wish to run on timers.

- For homes with high hot water usage and skewed to a single large morning or evening usage pattern, the DYNAMIC/X8 additional storage will benefit from meeting demand.

- Due to the higher heating frequency, the RAPID/X6 is slightly less efficient than the DYNAMIC/X8 across an entire year. This efficiency difference is minor and would typically represent a difference in running costs between the two systems of less than $20 per year.

HEATING CAPACITY

Heating Capacity as a measure of a heat pump's performance should be a critical specification for any new purchaser to consider. It is one of the essential parameters to determine whether a system will suit your home's needs and how it is likely to perform under specific operating conditions.

When designing the RAPID/X6 as a genuine alternative to Gas & Electric systems, we wanted to ensure its functional heating capacity across all seasons of the year. We set three specific parameters we felt the RAPID/X6 would need to achieve to be suitable as a single model solution. These parameters were based on the system performance testing to standard *AS/NZS 5125: 2014 Heat pump water heaters.*

1. The RAPID/X6 heating capacity should align with an Electric element water heater across the three standard test conditions.

2. The RAPID/X6 must meet an A-Class rating for low-temperature heating performance.

3. The RAPID/X6 heating time for a full tank recovery under low-temperature conditions should not exceed 10 hours.

RAPID/X6 VERSUS ELECTRIC HOT WATER SYSTEM HEATING CAPACITY

Electric water heaters use restive elements to heat water. These elements are rated at different input powers, which directly correlate to their heating capacity. The standard element ratings for an electric hot water system are 2.4kW and 3.6kW, depending on whether the heater is installed on a 10Amp or 15Amp circuit.

	RAPID/X6	ELECTRIC 10Amp	ELECTRIC 15Amp
9°C Ambient	2370W	2400W	3600W
19°C Ambient	2650W	2400W	3600W
33°C Ambient	3450W	2400W	3600W

The above table shows the results of the RAPID/X6 performance testing under the three primary test conditions for AS/NZS 5125: 2014. The RAPID/X6 heating capacity is equal to or exceeds the heating capacity of an Electric hot water system on a 10Amp circuit. This showed that the RAPID/X6 was successful in meeting the first of our parameter goals.

RAPID/X6 CLASS A RATING LOW-TEMPERATURE PERFORMANCE

As part of compliance to Standard *AS/NZS 5125: 2014 Heat pump water heaters*. Manufacturers can determine the Class rating they wish to categorise the heat pump under. These Class ratings are specified on the system Low-Temperature Performance.

(a) Low-temperature Class A Suitable for low ambient temperature operation without auxiliary boosting.

(b) Low-temperature Class B Auxiliary boosting is required for low air temperature locations.

(c) Low-temperature Class C Limited to operation at ambient air temperature greater than 10°C.

The RAPID/X6 met the conditions for a Class A rating, completing the second of our parameter goals for heating capacity. This is important as it ensures that the RAPID/X6 can operate on heat pump alone even in subzero conditions, thus guaranteeing both hot water delivery and efficiency are maintained across a complete set of climate conditions.

TANK RECOVERY TIMES UNDER LOW-TEMPERATURE CONDITIONS

During *AS/NZS 5125* low-temperature testing, the heat pump is placed in a climate-controlled chamber at a relative -1°C air temperature. A complete heat cycle is performed to raise the water temperature from 8°C to 60°C.

We set a target time of 10 hours for the RAPID/X6 to complete the low-temperature heat cycle. Suppose the RAPID/X6 met this target. In that case, we could be confident that even in a subzero climate, the system would recover any morning hot water draw and ensure the tank was fully heated by evening.

LOW-TEMPERATURE HEATING TIME TO SET TEMPERATURE BASED ON MODE SELECTED

The above table shows the heat up time for a full tank recovery to set the temperature, at >0°C ambient conditions, is under 10 hours, for all heating modes. We are therefore satisfied that the RAPID/X6 heating capacity meets our third parameter goal.

	Start Temperature	Set Temperature	Heating Time
STANDARD	8°C	60°C	8h 28m
HYBRID	8°C	65°C	9h
HYBRID+	8°C	70°C	9h 28m
ELEMENT	8°C	70°C	8h

RAPID/X6 HEATING CAPACITY & RECOVERY BY SEASON

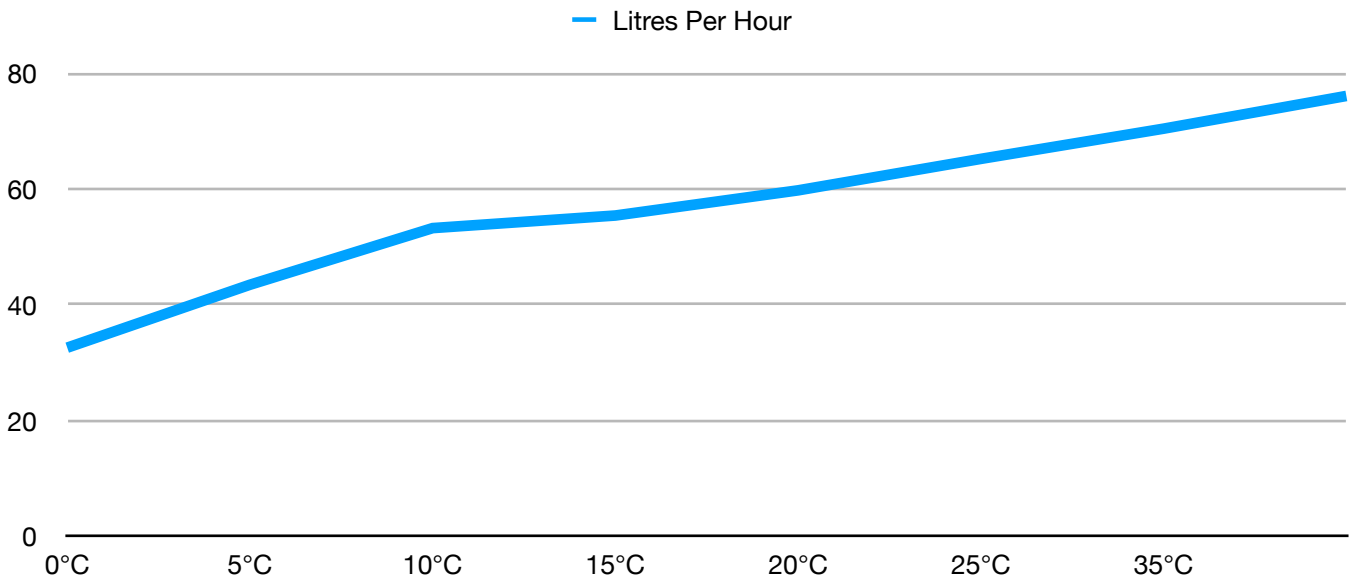
The lower ambient temperature has only a minor impact on the RAPID/X6 heating capacity and tank recovery between winter and summer. Instead, it is the lower inlet water temperature in Winter, resulting in longer tank recovery times.

Using a milder climate such as in Melbourne, Victoria, we can see how the ambient & inlet water temperature changes across the year impact the RAPID/X6 heating capacity & tank recovery times.

	Ambient Temperature	RAPID/X6 Heating Capacity	Cold Water Temperature	Rise To 60°C	Tank Recovery Time
SUMMER	25°C	3000W	20°C	40°C	3h
SPRING	15°C	2550W	15°C	45°C	4h 15m
AUTUMN	15°C	2550W	15°C	45°C	4h 15m
WINTER	10°C	2400W	9°C	51°C	5h 10m

RAPID/X6 LITRES PER HOUR RECOVERY BY AMBIENT TEMPERATURE

Another measurement for a system's heating capacity is the number of litres of hot water it can produce per hour (LPH). This measurement presumes a rise in temperature of 40°C; for heat pumps, the standard is 15°C - 55°C.



RAPID/X6 STORAGE CAPACITY

When determining the suitability of a hot water system to meet a homes needs. The volume of a storage tank is only relevant as it must hold enough hot water to meet the home's single highest demand draw.

FACTORS IMPACTING THE SINGLE HIGHEST DEMAND DRAW

- The number of daily showers and the average length.
- Hot water usage patterns: For example, a home where all occupants shower in the morning will have a more significant Single Demand Draw than homes where showers are spread between morning and night.
- Incoming mains water temperature. In winter, when the incoming cold water is at a lower temperature, more stored hot water is needed to mix to deliver hot water at 45°C

With these factors, you can calculate what the homes Single Highest Demand Draw is likely to be. The formula to use is:

The maximum number of showers that will be needed to be met in a single two-hour block.
Multiplied by
(The average length of the shower in minutes x 9L per minute flow rate)

Using the example of the above calculation, a four-person home where all residents shower between 6:00 pm - 7:00 pm and the average shower length is 5 minutes.

The Peak Single Demand calculation is 4 X (5 x 9) = 180L @ 45°C

As the stored water is at a higher temperature than 45°C, some cold water will be mixed in. The amount of cold water that is mixed will depend on the inlet water temperature. For most calculations, it is best to use a winter inlet temperature of 8°C.

In the example above, if there stored water in the tank is at 60°C, then only 125L will need to be drawn off to mix with cold water to deliver 180L of hot water at 45°C

THE RAPID/X6 ABILITY TO MEET THE SINGLE HIGHEST DEMAND DRAW

Part of the design process of the RAPID/X6 focused on the system being a "single model solution" that would be suitable to meet the hot water demands of the majority of homes where it was going to be installed. We set a minimum Single Highest Demand Draw of 270L hot water at 45°C with a cold water inlet of 8°C. This value equates to six continuous showers, each being five minutes in length or 30 minutes of constant showering time.

The below table shows the total volume of 45°C hot water, the RAPID/X6 can deliver in one continuous draw off based on a winter inlet water temperature of 8°C

	Inlet Temperature	Tank Temperature	Hot Water At 45°C	Continuous Shower Time
STANDARD	8°C	60°C	290L	32 minutes
HYBRID	8°C	65°C	315L	35 minutes
HYBRID+	8°C	70°C	335L	37 minutes

SINGLE HIGHEST DEMAND DRAW SUMMARY

- The highest demand draw is the maximum hot water home will use in short (less than two-hour block), which does not allow enough time for the system to recover fully.
- The rated storage capacity of a hot water system is only an essential factor when determining its suitability to meet a homes single highest demand draw.
- The single highest demand draw is always highest in winter due to colder inlet temperatures, requiring a large volume of stored hot water to be mixed down to 45°C.
- IN WINTER, the RAPID/X6 single highest demand draw is 290L of water at 45°C, equivalents to 32 minutes of continuous showering. If the use of the home exceeds this in a single block, the system will run out of stored hot water.

RAPID/X6 VERSUS DYNAMIC/X8 HOT WATER DELIVERY

We have already discussed how the RAPID/X6 has a lower tank sensor position when compared to the DYNAMIC/X8. This results in the RAPID/X6 recovery more frequently, which helps compensate for a smaller storage tank. However, there are other factors to compare the two models regarding their ability to meet a potential home hot water demand.

TANK RECOVERY COMPARISON

As the RAPID/X6 and DYNAMIC/X8 share the same core refrigeration components, they also have identical heating capacities and recovery rates in terms of litres per hour of production. However, the difference in storage tanks means the RAPID/X6 will full recover quicker than the DYNAMIC/X8. The below table compares the heating time to raise the stored water from 20°C to 60°C based on *AS/NZS 5125* test results.

	RAPID/X6	DYNAMIC/X8
0°C Ambient	6h 46m	8h 23m
9°C Ambient	4h 10m	5h 7m
19°C Ambient	3h 43m	4h 35m
33°C Ambient	2h 47m	3h 20m

SINGLE HIGHEST DEMAND DRAW COMPARISON

With 50L of extra storage, the DYNAMIC/X8 can meet a higher single demand draw than the RAPID/X6. The booster element in the DYNAMIC/X8 also has a larger volume of water above it. This amplifies the system's single draw demand capacity over the RAPID/X6 if the systems are running on one of the Hybrid modes. The higher single draw demand capacity of the DYNAMIC/X8 may be necessary for homes with high hot water usage, particularly if the demand is skewed towards a single time of day.

RAPID/X6	Inlet Temperature	Tank Temperature	Hot Water At 45°C	Continuous Shower Time
STANDARD	8°C	60°C	290L	32 minutes
HYBRID	8°C	65°C	320L	35 minutes
HYBRID+	8°C	70°C	340L	38 minutes
DYNAMIC/X8				
STANDARD	8°C	60°C	365L	40 minutes
HYBRID	8°C	65°C	395L	44 minutes
HYBRID+	8°C	70°C	425L	47 minutes

RAPID/X6 HOT WATER CAPACITY SUMMARY

- The RAPID/X6. thermal sensor has been positioned for more frequent heating. This ensures that the system storage tank should be at a full temperature more often.
- The RAPID/X6. heating capacity is equal to or exceed a standard 10Amp electric hot water system capacity being 2400W.
- Even in subzero ambient temperatures, the RAPID/X6. Can fully recover the stored water from 8°C to a set temperature of 60°C.
- The RAPID/X6. The storage tank is thoroughly heated and has enough capacity to meet a continuous draw of 6 showers of 5 minutes length; in winter before the system runs cold.
- The RAPID/X6 has a lower Single Highest Demand Draw capacity than the Dynamic/X8. This may be important for a limited number of homes.

SECTION 4: RAPID/X6 C.O.P EFFICIENCY & STCs

The RAPID/X6 incorporated the same R290 heat pump as the DYNAMIC/X8, with a proven track record of delivering high-efficiency heating and reduced running costs. The R290 heat pump can provide high-efficiency heating throughout the year due to its C.O.P, the factor of energy consumed versus heat transferred into the stored water.

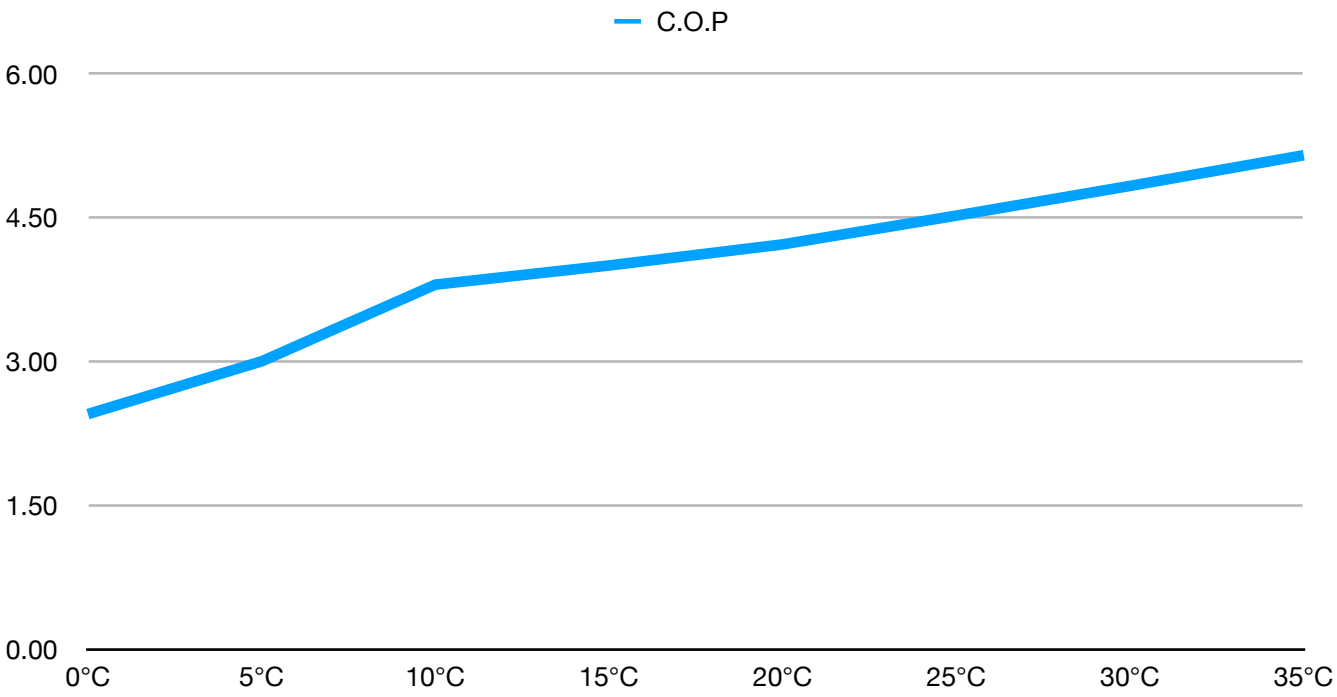
C.O.P CALCULATION FORMULA

Energy Transferred to stored water / Energy Consumed = C.O.P

As part of testing *AS/NZS 5125:2014 heat pumps,* the RAPID/X6 C.O.P has been independently calculated under four climate conditions. This provides a guide to how the system will perform in real-world installations.

C.O.P RESULTS FROM *AS/NZS 5125* TESTING

	Start Temperature	End Temperature	Energy Transfered	Energy Consumed	C.O.P
0°C Ambient	8.7°C	59.96°C	12.62 kW	5.22 kW	2.42
9°C Ambient	9.45°C	60.73°C	12.62 kW	3.66 kW	3.45
19°C Ambient	12.88°C	60.33°C	11.68 kW	2.82 kW	4.15
33°C Ambient	20.41°C	60.20°C	9.80 kW	1.96 kW	5.00



There is often misinformation regarding the efficiency and performance of heat pumps, both amongst trade professionals and public members. Past experiences may explain this with poorly designed heat pumps that were not optimised for low ambient temperature performance. Using the independent AS/NZS 5125 test results, we can dispel this misinformation about the RAPID/X6.

1. DISPELLING HEAT PUMP MYTHS

Heat pumps are only suitable for warmer climates

The *AS/NZS 5125* test results show that the perceived notion that heat pumps are only suitable or efficient in warmer climates is not valid. A quality heat pump such as the RAPID/X6 will still provide high efficiency even in 0°C ambient conditions, being on average 240% more efficient than a comparable electric hot water system.

RAPID/X6 VERSUS ELECTRIC HWS HEATING 210L OF HOT WATER AT 0°C AMBIENT

**Cost based on average tariff rate of 20 cents per kWh*

	Start Temperature	End Temperature	Energy Transfered	Energy Consumed	C.O.P	Cost*
RAPID/X6	8°C	60°C	12.55 kW	5.19 kW	2.42	$1.04
ELECTRIC HWS	8°C	60°C	12.55 kW	12.55 kW	1	$2.51

FACT: Even at 0°C ambient conditions, a RAPID/X6 is still 60% cheaper to run than electric hot water systems.

2. DISPELLING HEAT PUMP MYTHS

Heat pumps are only affordable to run in Summer

Other misconceptions with heat pumps are that they are only cheap to run in Summer but cost more the rest of the year. Part of this misconception is due to inlet water temperatures being lower in Winter, so more energy is required. Using the *AS/NZS 5125,* we can see that for the RAPID/X6, the system will perform at similar efficiency across the whole year. The real difference in costs is the amount of energy required to meet the load.

	Cold Water Temperature	Required Rise In Temperature to 45°C	Energy Required to deliver 300L @ 45°C
SUMMER	20°C	25°C	8.8 kW
SPRING	15°C	30°C	10.55 kW
AUTUMN	15°C	30°C	10.55 kW
WINTER	9°C	36°C	12.66 kW

INLET WATER TEMPERATURE IMPACT ON ENERGY REQUIRED TO DELIVER 300L @ 45°C

We can also compare the average seasonal ambient conditions to determine the RAPID/X6 C.O.P based *AS/NZS 5125* results. This will allow us to calculate the average daily energy & running cost to produce 300L of 45°C hot water.

	Average Ambient Temperature	RAPID/X6 C.O.P	Energy Required	RAPID/X6 Consumed Energy	Cost
SUMMER	20°C	4.2	8.8 kW	2 kW	$0.40
SPRING	15°C	3.8	10.55 kW	2.8 kW	$0.55
AUTUMN	15°C	3.8	10.55 kW	2.8 kW	$0.55
WINTER	10°C	3.5	12.66 kW	3.6 kW	$0.70

FACT

Seasonal ambient temperatures have little impact on the RAPID/X6 C.O.P. Energy consumption. Running costs are primarily due to lower inlet water temperatures, resulting in higher energy requirements to meet the same load.

USING ASSIGNED STC VALUE TO MEASURE EFFICIENCY

Separate to C.O.P, it is also possible to analyse a heat pump's annual efficiency based on the number of STC's the Clean Energy Regulator has assigned.

1 STC = 1000 kW of saved energy when compared to an electric or gas hot water system.

The STC value can represent the amount of annual energy a heat pump will save compared to an electric hot water system. It can be more comprehensive compared to the C.O.P rating as it incorporates additional factors.

1. The heat pumps C.O.P & Power efficiency from AS/NZS 5125:2014 test data.
2. The annual tank heat loss.
3. The system's performance in the specific climate zone it will be installed.
4. The hot water load size.

UNDERSTANDING HOT WATER LOADS & CLIMATE ZONES

As STC ratings are a factor of energy savings, there needs to be a reference value to compare the system energy consumption against. The reference values are provided under standard *AS/NZS 4234 Heated water systems–Calculating energy consumption*.

This standard prescribes the amount of energy required "purchased energy" to deliver an annual hot water load size - Small, Medium, Large. **Heat pumps are only compared against Medium loads for Electric hot water systems, for STCs.**

For STCs, there are five climate zones across Australia, each with its reference load. The reason for the five climate zones is that the "purchased energy" to meet a load is dependent on the inlet water temperature and ambient temperatures across the year. STC ZONE BY REFERENCED CITY & ENERGY MEDIUM LOAD HOW STCs VALUES ARE ASSIGNED

Zone	Reference City	Annual Purchased Energy Electric HWS
1	Rockhampton	3488 kWh
2	Alice Springs	3511 kWh
3	Sydney	4239 kWh
4	Melbourne	4630 kWh
5	Canberra	4680 kWh

When calculating STCs, the Heat Pump C.O.P is modelled based on the climate zone to determine its purchase. The difference between the Electric HWS purchased energy & the Heat Pump is the savings.

Zone	Electric HWS	RAPID/X6	Energy Saved	Saving as %
1	3488 kWh	931 kWh	2556 kWh	73.3%
2	3511 kWh	1158 kWh	2353 kWh	67%
3	4239 kWh	1250 kWh	2988 kWh	70.5%
4	4630 kWh	1486 kWh	3134 kWh	67.9%
5	4680 kWh	1563 kWh	3117 kWh	66.6%

An STC Value is assigned based on the energy savings are converted to Mwh, rounded down, and then multiplied by the 10 Years (as of 01/01/2022, the multiply is reduced by one year annually)

Zone	RAPID/X6 Savings	Mwh Savings	STC RATING
1	2556 kWh	2.5 Mwh	25
2	2353 kWh	2.3 Mwh	23
3	2988 kWh	2.9 Mwh	29
4	3134 kWh	31 Mwh	31
5	3117 kWh	31 Mwh	31

USING STCs VALUES TO PROVIDE ESTIMATED ENERGY SAVINGS

As stated, to assign an STC Value, only the Medium load is used as a reference. However, estimating the energy savings percentage as calculated for Medium load can still be applied to the Small & Large loads. This can be very useful in assisting owners in calculating the potential savings they could realise by switching an Electric hot water system to the RAPID/X6

Small Load - Equivalent to a two-person home

Zone	Electric HWS	RAPID/X6	Energy Saved	Saving as %
1	2017 kWh	539 kWh	1478 kWh	73.3%
2	2136 kWh	705 kWh	1431 kWh	67%
3	2575 kWh	760 kWh	1815 kWh	70.5%
4	2856 kWh	917 kWh	1939 kWh	67.9%
5	2899 kWh	968 kWh	1931 kWh	66.6%

Medium Load - Equivalent to a four-person home

Zone	Electric HWS	RAPID/X6	Energy Saved	Saving as %
1	3488 kWh	931 kWh	2556 kWh	73.3%
2	3511 kWh	1158 kWh	2353 kWh	67%
3	4239 kWh	1250 kWh	2988 kWh	70.5%
4	4630 kWh	1486 kWh	3134 kWh	67.9%
5	4680 kWh	1563 kWh	3117 kWh	66.6%

Large Load - Equivalent to a six-person home

Zone	Electric HWS	RAPID/X6	Energy Saved	Saving as %
1	4772 kWh	1274 kWh	3498 kWh	73.3%
2	4795 kWh	1582 kWh	3213 kWh	67%
3	5861 kWh	1729 kWh	4132 kWh	70.5%
4	6428 kWh	2063 kWh	4365 kWh	67.9%
5	6478 kWh	2164 kWh	4314 kWh	66.6%

To ensure accuracy in the data, we provide Aquatech Solar Technologies contracted an independent modeller to test that the RAPID/X6 can deliver a Large Load draw.

STCs VALUES TO PROVIDE ESTIMATED ELECTRICITY COST SAVINGS

Using the Energy Savings tables and the electricity suppliers tariff cost per kWh, you can provide estimated annual monetary savings owners can expect when switching from an Electric hot water system to the RAPID/X6.

Small Load - Equivalent to a two-person home

Zone	Electric HWS	RAPID/X6	Energy Saved	Tariff Cost	Annual Savings
1	2017 kWh	539 kWh	1478 kWh	$0.2 per kWh	$295
2	2136 kWh	705 kWh	1431 kWh	$0.2 per kWh	$286
3	2575 kWh	760 kWh	1815 kWh	$0.2 per kWh	$363
4	2856 kWh	917 kWh	1939 kWh	$0.2 per kWh	$388
5	2899 kWh	968 kWh	1931 kWh	$0.2 per kWh	$386

Medium Load - Equivalent to a four-person home

Zone	Electric HWS	RAPID/X6	Energy Saved	Tariff Cost	Annual Savings
1	3488 kWh	931 kWh	2556 kWh	$0.2 per kWh	$511
2	3511 kWh	1158 kWh	2353 kWh	$0.2 per kWh	$470
3	4239 kWh	1250 kWh	2988 kWh	$0.2 per kWh	$598
4	4630 kWh	1486 kWh	3134 kWh	$0.2 per kWh	$627
5	4680 kWh	1563 kWh	3117 kWh	$0.2 per kWh	$623

Large Load - Equivalent to a six-person home

Zone	Electric HWS	RAPID/X6	Energy Saved	Tariff Cost	Annual Savings
1	4772 kWh	1274 kWh	3498 kWh	$0.2 per kWh	$700
2	4795 kWh	1582 kWh	3213 kWh	$0.2 per kWh	$643
3	5861 kWh	1729 kWh	4132 kWh	$0.2 per kWh	$826
4	6428 kWh	2063 kWh	4365 kWh	$0.2 per kWh	$873
5	6478 kWh	2164 kWh	4314 kWh	$0.2 per kWh	$863

STCs VALUES TO PROVIDE ESTIMATED GAS COST SAVINGS

AS/NZS 4234 also provides reference energy consumption for Gas water heaters. As Heat Pumps & Gas water heaters consume different fuels, you need to compare the two systems' separate running costs to estimate savings.

Small Load - Equivalent to a two-person home

Zone	RAPID/X6 (kWh)	Cost per kWh	Annual Cost	GAS HWS (Mj)	Cost per Mj	Running Cost	GAS Connection Fee	Annual Cost	RAPID/X6 SAVINGS
1	539	$0.2	$108	13 690	$0.02	$274	$290	$564	$456
2	705	$0.2	$141	14 190	$0.02	$284	$290	$574	$433
3	760	$0.2	$152	16 410	$0.02	$328	$290	$480	$328
4	917	$0.2	$183	17 930	$0.02	$359	$290	$649	$466
5	968	$0.2	$194	18 360	$0.02	$367	$290	$657	$463

Medium Load - Equivalent to a four-person home

Zone	RAPID/X6 (kWh)	Cost per kWh	Annual Cost	GAS HWS (Mj)	Cost per Mj	Running Cost	GAS Connection Fee	Annual Cost	RAPID/X6 SAVINGS
1	931	$0.2	$186	18 890	$0.02	$378	$290	$668	$482
2	1158	$0.2	$232	19 110	$0.02	$382	$290	$672	$440
3	1250	$0.2	$250	22 690	$0.02	$454	$290	$744	$494
4	1486	$0.2	$297	24 720	$0.02	$494	$290	$784	$487
5	1563	$0.2	$313	25 140	$0.02	$503	$290	$793	$480

Large Load - Equivalent to a six-person home

Zone	RAPID/X6 (kWh)	Cost per kWh	Annual Cost	GAS HWS (Mj)	Cost per Mj	Running Cost	GAS Connection Fee	Annual Cost	RAPID/X6 SAVINGS
1	1274	$0.2	$255	24 990	$0.02	$500	$290	$790	$535
2	1582	$0.2	$316	25 210	$0.02	$504	$290	$794	$478
3	1729	$0.2	$346	30 400	$0.02	$608	$290	$898	$552
4	2063	$0.2	$413	33 240	$0.02	$665	$290	$955	$542
5	2164	$0.2	$433	33 640	$0.02	$673	$290	$963	$530

SUMMARY OF C.O.P & STCs

- C.O.P is calculated based on the amount of energy transferred to heat water divided by the energy used to run the heat pump.

- The RAPID/X6 is still 240% more efficient than an electric hot water system at subzero temperature.

- The RAPID/X6 cost more to run in Winter versus Summer, but this is due to the higher energy load required; system efficiency has only a minor impact.

- STC values can provide an independent means to determine the RAPID/X6 energy savings compared to Electric hot water systems.

- STC values are based on climate zones as well as reference hot water loads.

- STC values relate directly to the percentage of energy the RAPID/X6 saves compared to an electric hot water system and reference Medium Load.

- For Heat Pumps, STC values only apply to a Medium Load. However, the RAPID/X6 energy percentage savings are equivalent when compared against Small & Large Loads.

- Reference Hot Water Loads can be related to household size:
  Small = 2 Person, Medium = 4 Person, Large = 6 Person.

- If the supply tariff rate is known, STC energy percentage savings can be converted to estimate electricity cost savings.

- STC calculations show the RAPID/X6 annual energy consumption. This value can be used to compare savings if the RAPID/X6 replaces a gas hot water system.

- If replacing a gas hot water system with a RAPID/X6

  (Gas annual cost based on reference system usage X cost per Mj) + Gas Connection fee

  -

  (RAPID/X6 annual energy usage x Electricity tariff per kWh)

  = ANNUAL COST SAVINGS

SECTION 5: **CONTROLLER & HEATING MODES**

The RAPID/X6 controller is a simplified version of the DYNAMIC/X8 colour touch-screen LCD monitor. This paired-down design provides intuitive buttons to access heating modes and diagnostics; there is no sacrifice in performance or optimisation.

KEY FEATURES OF THE RAPID/X6 CONTROLLER

1. Built-in Timers

Use the timer function to set up to three heating windows per day.

- Use to synchronise heating cycles with home Solar PV.
- Prevent system heating late at night or early morning when hot water usage is lowest.
- Prevent the system heating at times when running noise is of concern.

Factors to consider when using timers.

- Specific tariffs will not coincide with the default timer periods, so the system may not have enough time to recover.
- Hot water usage - Be aware of your peak usage and recovery times.
- Temperature & Climates - Ensure you allow enough time for the unit to heat in winter when recovery is slower.
- Heating times. – We recommend a minimum of three hours per timer window. This will leave enough time for the system to recover.

The controller is pre-programmed with a default timer period (06:00 – 18:00) activated if the timer feature is turned on. This default window is typically the hottest part of the day when C.O.P and Solar P.V production are highest.

2. Five Primary Heating Modes

The controller comes programmed with four heating modes, each with a unique Set and Trigger temperatures to optimise capacity and efficiency. This makes it easier to match a hot water demand with a single button input.

STANDARD

Set temperature: 60°C
Reheat trigger: 55°C
Heating Method: R290 heat pump.
Efficiency Impact: No negative impact

STANDARD mode is the default selection when the system is turned on. If the system is on a continuous tariff without timers, the stored water should always be above 55°C, ensuring it can mix effectively through tempering valves.

ECO

Set temperature: 60°C
Reheat trigger: 48°C
Heating Method: R290 heat pump.
Efficiency Impact: Slight improvement in annual efficiency.

ECO mode lowers the reheat trigger temperature to reduce the frequency of heat cycles and deliver increased efficiency. Smaller homes of 1 - 2 persons may see some cost reductions by running in ECO mode.

It is also recommended to place the system in ECO mode if the system is not going to be used for more than a week, i.e. if owners are on vacation. This will limit the heating while still ensuring the water remains sterilised.

HYBRID

Set temperature: 65°C
Reheat trigger: 55°C.
Heating Method: Heat pump heats to 60°C, then element from 60°C to 65°C.
Efficiency Impact: The system will consume an additional 0.9kWh per heat cycle.

In homes with a high Single Demand Draw, HYBRID mode can increase the available hot water by 10% compared to running on STANDARD mode or an additional three minutes of constant showering.

If the system is installed in regions where the winter inlet water temperature is >10°C or the system is on timers. The higher set water temperature can improve mixing through tempering valves to ensure 45°C at the home's outlets.

HYBRID+

Set temperature: 70°C
Reheat trigger: 50°C.
Heating Method: Heat pump heats to 60°C, then element from 60°C to 70°C.
Efficiency Impact: The system will consume an additional 1.8kWh per heat cycle.

HYBRID+ mode is primarily designed for installations where legionella and sanitation standards require a high set temperature, such as aged care facilities or commercial kitchens that have untempered water to dishwashers.

HYBRID+ mode would only be recommended for domestic installations in rare cases where the Single Demand Draw exceeds the 330L @ 45°C winter delivery under HYBRID mode. If this is due to a transient increase in the number of occupants in the home, i.e. visiting guests, running in HYBRID+ mode for a period, it may assist in meeting the demand.

Systems installed against our recommendations on a Night-Time Tariff may also need to run in HYBRID+ mode. This is to ensure that the stored hot water temperature is high enough to allow for the equalisation with the colder water that has entered the tank. This equalisation will occur over the 18 hours when tariff power is turned off, and the system can not heat. If the equalised tank temperature drops below 45°C, it will no longer be sufficient to provide hot water at outlets.

The equalisation effect can also occur if the system heating is limited to a single timer window in colder climates with lower inlet water temperatures or high hot water demand. In this environment, HYBRID+ mode is not recommended as a counter to equalisation. The system will operate more efficiently and provide a higher hot water demand if the timer window is extended and run on STANDARD or HYBRID mode.

ELEMENT

Set temperature: 70°C
Reheat trigger: 60°C.
Heating Method: All heating is via the 1.8 kW backup element from 60°C to 70°C.
Efficiency Impact: The system will consume 7.20 kWh per heat 40°C heat cycle.

ELEMENT mode is used to provide hot water if there is an issue with the heat pump that requires an onsite service. Running the system on ELEMENT mode will provide a limited hot water supply until servicing can be completed works are arranged.

Under this ELEMENT mode, the top 155L of the stored water is heated via the 1800W inbuilt electric restive element. This mode provides approximately 50% heating capacity compared to the R290 heat pump and is recommended short-term rather than a permeant operating mode.

3. DISPELLING HEAT PUMP MYTHS
Heat Pumps with a booster element are inefficient.

It is true that certain heat pumps with an insufficient heating capacity or having a Class B low-temperature rating, will use an electric element to compensate for the systems poor design and capabilities. However, the inclusion of a booster element can also provide a number of benefits when deployed in a well-designed heat pump.

The main reason we choose to include an element in the RAPID/X6 is as a failsafe to provide heating under fault conditions. This ensures that even if the R290 heat pump experiences a service or performance issue, the home does not need to be without hot water.

The element is also useful to provide temperature boosting beyond the standard limits of the heat pump. This is important if temperatures above 60°C are required for compliance with standards. In order to ensure system durability and longevity, any heating above 60°C is done with the element. This ensures that the refrigeration components such as the compressor never run above their rated maximum operating temperatures and pressures.

The control mechanism for the RAPID/X6 will only employ the element under the following conditions.

The ambient temperature is <-5°C

In these extreme climate conditions, the heating capacity drops to less than 1200W and recovery times are excessive, reducing the heat pumps ability to produce a reliable hot water supply. Once ambient conditions return >-5°C the heat pump will again resume all heating.
In Australia, these ambient temperatures are only likely to occur in extreme alpine conditions over winter.

The ambient temperature is >43°C

In these conditions, the refrigerant can be exposed to excessive pressure and heat as it is not possible to fully transfer the energy into the stored water. For system longevity, it is safer to use the booster element.

HYBRID | HYBRID+ | ELEMENT

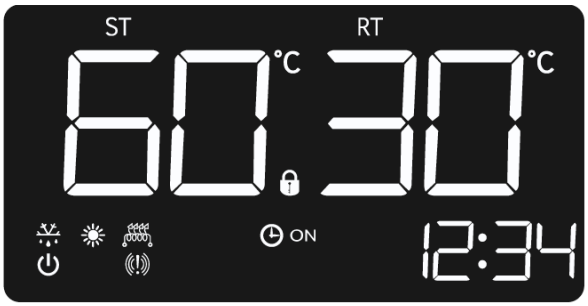
The element will engage for some or all of the heating if any of the following modes are selected.

FACT

The RAPID/X6 can deliver a large load rating without the need for element heating, even in peak winter demand. The inclusion of the element does not impact the system efficiency when operating in STANDARD & ECO modes.

3. Live Temperature Readings & Faults

The controller displays live readings of the set temperature & current tank sensor temperature to show how much hot water is available at any time. It is also useful as a quick diagnostic tool to determine if a lack of hot water is due to the tank running cold or if the issue is related to the home's internal plumbing. Any system faults are also displayed, so owners can quickly identify issues.



4. Diagnostic / Service Menu

The diagnostic menu displays live readings of all refrigeration parameters and sensor temperatures, to provide an analysis of heating performance, without the need for refrigeration gages. Using the diagnostic readings, the vast majority of system issues can be identified and rectified over the phone with owners or technicians. This significantly reduces service response times and costs.

ANALYSIS PARAMETERS DISPLAYED IN THE DIAGNOSTIC MENU

CODE		
01	High Pressure Switch	Indicates if refrigeration circuit has run above maximum operating conditions.
02	Low Pressure Switch	Indicates if refrigeration circuit has potential leak or loss.
04	EEV value	Used to adjust system refrigeration operating pressures.
05	Evaporator sensor	These three temperature readings can determine the heat transfer that is occurring between the refrigerant and stored water. The can also provide an indication of how quickly the water temperature should be rising based on the systems heating capacity.
06	Ambient sensor	
07	Suction sensor	
08	Compressor sensor	These temperature readings can determine how much hotter the compressor is running than the water in the tank. If the compressor temperature is excessively high relative to the water, then there could potential refrigerant issue.
09	Tank water sensor	
11	Compressor state	Used to check if the compressor is activating for heating.
12	4-way valve	Used to check system defrost function is operating correctly.
13	Fan state	Used to check current fan speed and functions.

SECTION 6: RAPID/X6 CONSTRUCTION FEATURES

EXTERIOR FEATURES

Controller Cover

The RAPID/X6 controller display is protected by a metal cover formed from the same material as the system's outer casing. This cover is held in place by two thumbscrews making it easily removed by owners for access. The cover features a rubber seal in black to provide additional protection to the electronics from water ingress. This cover full protects the display from the effects of the harsh Australian sun, which can cause a rapid deterioration of the display components and any exposed plastics.

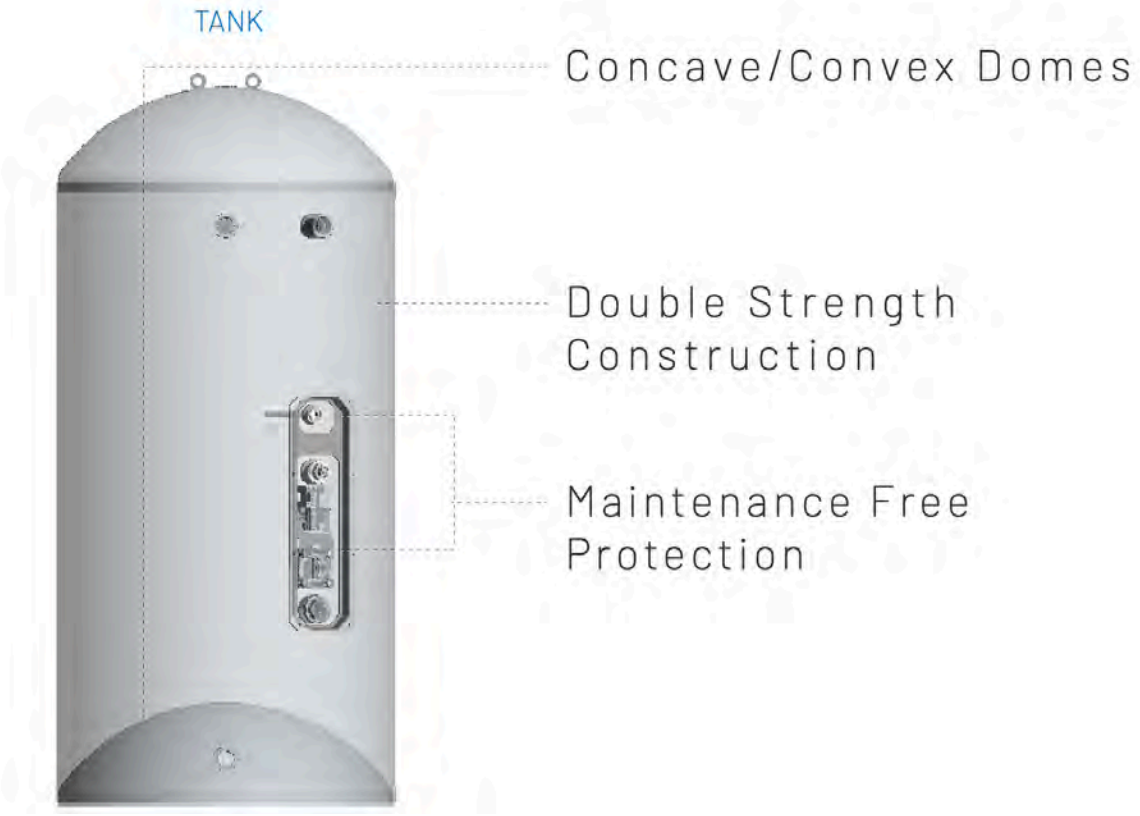
Duo-Shield Casing

The RAPID/X6 outer casing is manufactured from galvanised zinc sheets to provide exceptional resistance to corrosive elements, preventing the casing from rusting. Once constructed the casing is finished with auto paint, to hide any weld lines and provide a clean uniform finish.

Service Access Panel

The system's electric element, impressed current anode and temperature sensor are all easily accessible via the service panel on the left side of the system. This panel allows for onsite servicing without the need to disconnect the system from the plumbing network.

TANK FEATURES



Concave/Convex Domes

The RAPID/X6 inner tank features a top concave dome and bottom convex dome design. The advantage of this design is that it allows the heat exchanger to reach 97% of the stored water. This reduces stratified cold water zones, ensuring a full 210L of hot water is available after each heating cycle.

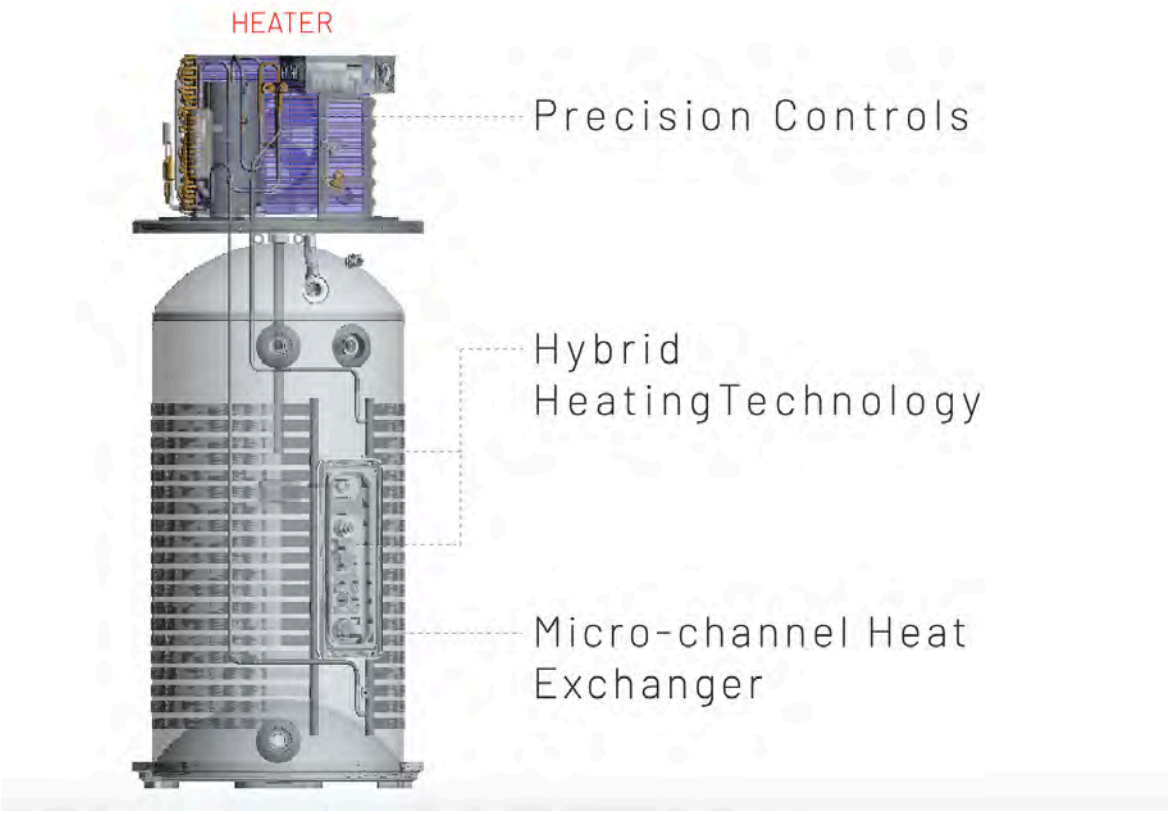
Double Strength Construction

The RAPID/X6 inner tank walls are constructed from 2.5mm high tensile steel sheeting, coated in Class X -0.03mg/mm2 vitreous enamel. These construction specifications are up to twice the thickness of competitor products, providing a more durable, long-lasting inner tank.

Maintenance Free Protection

The RAPID/X6 impressed current anode incorporates technology traditionally found in corrosion protection of marine vessels and oil rigs. Impressed current anodes are non-sacrificial and don't require regular replacing as is the case with magnesium or zinc anodes. The micro-voltage charge neutralises corrosive negative ions to ensure the tank will not rust even in hard water conditions.

REFRIGERATION FEATURES



Precision Controls

The RAPID/X6 heat pump incorporates an electronic expansion valve for refrigerant pressure regulation and a co-axial multi-speed fan for airflow regulation. The intelligent controller adaptively regulates the fan speed and EEV opening based on ambient and tank temperatures. This maximises heating capacity and reduces power consumption across the operating range of -5°C to 43°C.

Hybrid Heating Technology

Hybrid heating combines the R290 heat pump with an intelligent controlled 1800W boosting element. This allows the RAPID/X6 to deliver hot water at 70°C without placing undue pressure on refrigerant components. Owners can also activate the element to provide hot water if a fault occurs with the heat pump.

Micro-channel Heat Exchanger

The RAPID/X6 heat exchanger replaces the traditional copper coil with a micro-channel heating sleeve constructed from an aluminium composite. This heat exchanger has many advantages–better heat distribution over the larger surface area, reducing dead zones. Lower drop-in refrigerant pressure, increasing COP–higher corrosion resistance for increased durability.

SECTION 7: RAPID/X6 UNIQUE SELLING FEATURES

QUIETER RUNNING NOISE

We understand the importance of minimising noise impact. So spent two years focused on reducing operating decibels by optimising fan speeds and acoustic dampening materials. The RAPID/X6 now features one of the lowest operating sound levels of any heat pump on the market.

As there is no set standard in Australia for testing the running sound level of heat pumps, we had the RAPID/X6 independently tested to international standard ISO 3745:2012 which is recognised as the leading test for running noise.

42 db(A)

Outdoor running level at 1.5m

The typical background noise in a library is between 40 - 44 db(A)

GREENER REFRIGERANT

The R290 Propane refrigerant charge in the RAPID/X6 is a hundred per cent natural, containing no ozone-depleting substances. It also has zero global warming potential when compared to traditional R134a and R410a refrigerants.

R290 also offers a number of additional advantages, over mixed blend refrigerants.

- A lower operating pressures result in less strain on the refrigeration network.
- Requires only 1/3rd of the charge allowing for a smaller more compact heat pump design.

0.02 GWP

The GWP of R134a is 1300 so a typical heat pump with a 1200g charge has the equivalent of 1.5 Tons of carbon built-in.

PLUMBER FRIENDLY DESIGN

The RAPID/X6 compact design is based on the exact dimensions of a standard 250L electric hot water system, making replacement installations quicker and easier. It is also up to 30% shorter and narrower than competitor integrated heat pumps, so it is suitable to install in a wider variety of locations.

The RAPID/X6 also features dual-handle inputs for cold water inlets and hot water outlets. This provides plumbers with more flexibility when installing the system to a home's existing plumbing network.

1580mm(H) X 620mm(D) / Dual Handled

The RAPID/X6 is 30% shorter and narrower then competitor integrated heat pumps.

BACK-UP HEATING MODE

Hot water emergencies, happen when you least expect them! So the RAPID/X6 controller features a backup element only mode. If an owner experiences a fault with the heat pump switching to element mode will activate the electric element, heating 75%, of stored water to 70˚c.

The inclusion of a backup element mode can ensure that owners can be guaranteed a supply of hot water if service works are required. This reduces the pressure on service agents and provides a higher level of owner satisfaction.

150L heated to 70°C (Element Mode

Element mode provides hot water even under fault conditions.

COMPATIBLE WITH TARIFFS

The RAPID/X6 can be installed on a continuous or shoulder power tariff, the inbuilt timers can also be programmed to align with time-of-use tariff rates. This allows owners the flexibility to run their system at the lowest possible cost.

Limiting the RAPID/X6 heating either by installing on a power tariff or via the in-built timers selected will impact the system's hot water delivery capacity. To ensure the system can meet owners' expectations we have independently tested the RAPID/X6 delivery capabilities when connected to restricted power tariffs.

Recommended Tariffs based on the No. of occupants in the home.

TARIFF	No. Of Occupants MILD CLIMATE	No. Of Occupants COLD CLIMATE
Continous	👤👤👤👤👤👤	👤👤👤👤👤
Shoulder	👤👤👤👤	👤👤👤👤
T.O.U	👤👤👤👤	👤👤👤

COMPATIBLE WITH SOLAR P.V

The RAPID/X6 built-in timer function, allows owners to synchronise heating windows, with Solar P.V output. The 210L storage tank with 60mm insulation, ensure hot water is still available, even if heating times are limited.

Running the system off Solar P.V can reduce the cost per kWh of power from 20c to 6c providing significantly lower running costs.

Solar Timer recommendations per the No. of occupants in the home.

Solar-Timer Window	No. Of Occupants MILD CLIMATE	No. Of Occupants COLD CLIMATE	Estimated percentage of power delivered by Solar P.V
6am - 6pm	👤👤👤👤	👤👤👤👤	80%
10am - 3pm	👤👤👤	👤👤👤	100%

DESIGN AESTHETICS

COMPACT
A smaller less intrusive installation footprint to complement more home facades.

MODERN
The sleek , cylindrical design integrates the heat pump & tank into a single unit.

NEUTRAL
Titanium grey colour scheme with black highlights complements exterior facades.

UNIFORM
Metal exterior construction eliminates the use of degrading plastic components.

DURABLE
Galvanised zinc casing finished with auto-grade coating for superior rust protection.

REPLACEMENT WARRANTY

In order to provide, peace of mind for all customers, the RAPID/X6 is supported by a Five Year Replacement Warranty. Covering the tank as well as all electronics & refrigeration components.

Should the system suffer a major failure being a Tank Leak or a non-repairable failure of the heat pump circuit a replacement system will be provided free of charge.

5 Year Full System / 2 Year Onsite Labour

Peace of mind is guaranteed with a full five-year warranty.

SECTION 8: COMPETITOR SPECIFICATION ANALYSIS

	AQUATECH RAPID/X6	MIDEA RSJ-15/190RDN	STIEBEL WWK222H	ISTORE PASHW008-180LD	ENVIROHEAT 200EH1-14	EVOHEAT EVO150
						
CAPACITY						
Tank Delivery	210L	170L	220L	180L	195L	150L
Heat Pump Output 20°C Ambient	2650W	1500W	1600W	1920W	1700W	1700W
DIMENSIONS						
Height	1580mm	1580mm	1500mm	1956mm	1692mm	1623mm
Diameter	620mm	580mm	690mm	540mm	629mm	568mm
Weight	108Kg	90Kg	120kg	93Kg	91Kg	91Kg
ELECTRICS						
Supply	220-240 V/ 50-60 Hz	220-240 V/ 50-60 Hz	220-240 V/ 50-60 Hz	220-240 V/ 50-60 Hz	220-240 V/ 50-60 Hz	220-240 V/ 50-60 Hz
Circuit	10Amp	15Amp	10Amp	10Amp	10Amp	10Amp
Element Rating	1800W	2150W	1500W	1500W	1500W	1500W
STC RATING						
Zone 1	25	24	25	25	24	25
Zone 2	23	23	26	26	23	25
Zone 3	29	29	29	30	29	29
Zone 4	31	31	31	32	31	31
Zone 5	31	28	31	31	30	31
REFRIGERANT						
Type	R290	R134	R134	R134	R134	R134
Charge	350g	800g	850g	Unspecified	900g	Unspecified
WARRANTY						
Tank	5Yr	5Yr	5Yr	5Yr	5Yr	5Yr
Compressor	5Yr	3Yr	2Yr	2Yr	5Yr	2Yr
Parts	5Yr	1Yr	2Yr	2Yr	1Yr	2Yr
Labour	2Yr	1Yr	2Yr	2Yr	1Yr	1Yr