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ENGINEERING HYDROSTATIC PRESSURE RELIEF IN FIBREGLASS POOLS:
A TECHNICAL REVIEW OF THE HYDROPRO VALVE SYSTEM, PATENT-PROTECTED DESIGN, AND VERIFIED PERFORMANCE

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Abstract

Hydrostatic uplift and differential groundwater pressure remain a principal structural risk for in-ground pools, particularly fibreglass shells where bulging and cracking are recognised failure modes when external groundwater pressure exceeds internal pool water pressure. Conventional hydrostatic relief solutions are widely associated with delayed opening thresholds, limited flow capacity, leakage, servicing burden, and inconsistent reseating.

This document-based technical review evaluates HydroPro by first explaining the engineering principles disclosed in the source material, then addressing the patent-protected technology, and then considering the independent comparative verification testing and independent engineering opinion. It focuses on:

(i) a near-balanced effective-area sealing geometry (opening/closing effective area ratio >= 0.9; preferably > 0.97) to increase sensitivity to small pressure differentials,

(ii) a large flow-path and gap geometry intended to enable high relief rates, and

(iii) constraint and sealing features intended to promote automatic resealing after pressure equalisation.

(iv) an 'in-situ' commissioning and functional assurance pathway arising from integration into the pool shell. Unlike traditional hydrostatic valves that are commonly bench-tested in air, the HydroPro valve is installed as part of the pool and is therefore subjected to submerged operating conditions immediately upon filling. This provides a practical in-situ assessment of installation integrity, sealing performance and operational readiness under representative wet conditions, complemented by manufacturer pre-integration quality checks prior to incorporation into the shell.

The installation manual is treated as materially relevant to real-world performance because it specifies a drainage and standpipe architecture, bedding media, and workmanship controls that standardise approach flow, venting, and seal integrity. The review is further informed by independent comparative verification testing of activation head, flow rate and resealing behaviour, and by a separate independent engineering opinion interpreting those results. A structured verification pathway remains proposed via bench differential-pressure testing, controlled flow testing, fouling tolerance trials, and retrospective field-performance auditing. Manufacturer-reported long-term field outcomes (no reported hydrostatic structural failures in fitted shells over approximately a decade) are treated as a high-value claim requiring transparent, auditable substantiation for journal-grade conclusions.

Keywords: *hydrostatic uplift; hydrostatic relief valve; fibreglass pool shell; groundwater; pressure differential; effective area ratio; flow capacity; reseating reliability.*

Nomenclature

- **Δh** = hydraulic head differential across the valve (mm water)
- **ΔP** = pressure differential (Pa), where $\Delta P = \rho g \Delta h$
- **Q** = flow rate (L/min)
- **A_open / A_close** = effective opening/closing areas
- **R** = effective area ratio (A_open / A_close)

1. Introduction

1.1 Hydrostatic risk in in-ground pools

In-ground pools behave as upwardly open shells embedded in soil. Internal pool water pressure tends to oppose uplift, while external groundwater pressure beneath or around the shell can rise rapidly during heavy rainfall, flooding, or changes to drainage conditions. When external pressure exceeds internal pressure, a differential-pressure condition develops that can generate uplift and deformation. Patent background materials describe bulging and cracking as common failure modes for fibreglass pools under such conditions, while floating is noted as more common for concrete pools [1].

Historically, hydrostatic risk has been treated as unpredictable and site dependent. Accordingly, hydrostatic-related deformation and uplift have often been excluded from manufacturer warranties and homeowner insurance policies, elevating the importance of reliable relief performance and verifiable installation controls.

1.2 Conventional hydrostatic relief approaches and typical failure modes

The patent family describing HydroPro characterises two common hydrostatic relief approaches in the marketplace: (i) small spring-loaded disc and O-ring valves (often on the order of 50 mm body diameter), and (ii) large aperture 'grease plate' valves (on the order of 160 mm aperture) requiring diver intervention after operation [1]. These approaches are described as being limited by delayed opening thresholds, throttled relief capacity, and/or reseating and leakage issues. In practice, hydrostatic control is a differential-pressure and flow-rate problem: the valve must open early and relieve pressure at a rate sufficient to prevent damaging uplift loads from accumulating. In qualitative industry terms, small spring-loaded disc or O-ring valves are often associated with comparatively large differential heads. In qualitative industry reporting, patent background discussions and investigations, opening thresholds for small spring-loaded valves are commonly described in the order of several hundred millimetres of water head, allowing pressure to continue accumulating during rapid groundwater rise.

In many installations, the hydrostatic relief valve is a commoditised component sourced and tested by third-party suppliers, then installed through the shell or associated fittings by parties other than the shell manufacturer. As a result, functional performance in service depends not only on device design, but also on the quality of the interface (cut-out, bonding, sealant, torque, alignment) and the extent to which component-level testing reflects submerged, pressure-cycled conditions once integrated into a fibreglass shell.

Industry anecdotal reports describe shell 'popping', cracking, and localised movement during intense rainfall, flooding, or when pools are partially drained for renovation, repair, or plumbing modifications. In these scenarios, conventional valves and their interfaces may be compromised by debris ingress, fines migration, seal-face contamination, distortion from over-tightening, thread damage, or loss of seating due to shell flexure and differential movement between the valve body, shell laminate, and connected pipework. Where the valve does not open promptly, cannot pass sufficient flow, or fails to reseat reliably after equalisation, uplift and deformation loads can propagate into shell walls and floors and impose additional stresses on penetrations and pipework (e.g., shear at fittings, misalignment, or leakage). These observations are qualitative and support the case for structured field auditing and controlled testing (Section 9.2).

1.3 Standard context referenced in the source material

The patent text references AS/NZS 1839:1994 in noting that pressure relief valves should operate such that the maximum differential across the valve cannot exceed approximately 30 mm of water, and further notes inventor investigations that various existing valves do not open at this differential [1]. The installation documentation references AS1839:2021 for standpipe and drainage provisions, indicating that system performance is treated as an interface between valve mechanics and subshell drainage architecture [6].

Note: The patent text references AS/NZS 1839:1994 in noting that pressure relief valves should operate such that the maximum differential across the valve cannot exceed approximately 30 mm of water. Subsequent revisions of the standard have adopted a broader performance-based approach and do not prescribe a specific activation differential. Accordingly, the 30 mm value is referenced in this review as a historical benchmark and engineering point of reference rather than a current compliance requirement.

Notwithstanding these references, there is no dedicated Australian Standard (or equivalent code-based construction methodology) that prescribes verification or performance requirements for hydrostatic relief valves as used in concrete or fibreglass pool shells. In that context, it is imperative that manufacturers and suppliers of such products stand behind the testing they undertake (and the assumptions that sit behind it) for the purpose of underpinning the structural integrity of the concrete and fibreglass shell and their interfaces (including penetrations and connected pipework).

2. Materials and Methods

2.1 Review design

This manuscript is a document-based engineering review. It first explains the engineering principles underpinning hydrostatic pressure relief, then identifies the patent-protected technology, then considers the independent comparative verification testing and independent engineering opinion.

It synthesises: (i) granted patent specifications describing the HydroPro operating principle, claimed performance envelope and prior-art context; (ii) manufacturer installation documentation describing the required site interface and workmanship controls that influence field performance; (iii) the independent comparative verification testing reported by Foley (2026); and (iv) the independent engineering opinion provided by Rickard (2026).

The review is intended to support decision-grade understanding for senior executives, regulators, insurers, certifiers and technically literate stakeholders.

In addition to the document corpus reviewed, representatives of NextGen Experts and Rickard Engineering undertook a controlled, non-destructive on-site inspection of an installed HydroPro unit within a dedicated test pool environment. The unit was represented as having been in continuous service for approximately a decade without material modification. That inspection was limited to configuration verification and observable condition at the time of inspection, together with observation of aspects of the unit's operation in situ. The controlled comparative differential-pressure opening tests, calibrated flow testing, resealing assessment and related verification testing were separately undertaken and reported by Angus Foley in Hydrostatic Pressure Relief Valve Comparative Verification Testing. This review relies on Foley's report for those measured comparative testing outcomes.

2.2 Document corpus

The primary technical sources include granted patent documents in Australia, New Zealand, the United States and Europe, together with the Hydrostatic Valve Installation Manual (Version 8, dated 23 Feb 2022), the independent comparative verification testing report prepared by Angus Foley, and the independent engineering opinion prepared by Charles Rickard [1-8]. A jurisdictional list of granted patents reviewed is provided in Appendix A.

2.3 Data extraction and synthesis approach

For each source document, the following data were extracted: (i) mechanism geometry and functional relationships (effective areas, motion constraints, seal design), (ii) reported performance thresholds and ranges (opening sensitivity and relief flow rate intent), (iii) stated prior-art limitations, and (iv) installation dependencies (drainage, media, venting, assembly checks). Extracted statements were mapped to measurable engineering parameters to support the future validation program discussed in Section 9.2.

2.4 Comparator framework

Comparators were defined by the valve categories explicitly discussed in the patent background as representative of common marketplace designs: spring-loaded disc and O-ring valves and grease plate valves [1]. The comparison is therefore functional rather than brand-specific, focusing on opening threshold, relief capacity, resealing reliability, fouling tolerance, and system installation dependence.

3. HydroPro mechanism

3.1 Near-balanced effective-area design and opening sensitivity

Development documentation provided by MP Hydro Pty Limited describes a service-representative submerged test method intended to avoid the common limitation of bench testing hydrostatic valves "in air". In this configuration, the valve is installed beneath a water column approximating pool depth, while the downstream pipework is subjected to controlled external head to model groundwater rise. Under these submerged, pressure-differential conditions, typical spring-loaded industry valves were observed to remain closed until $\Delta h \approx 300$ mm, i.e. $\Delta P = \rho g \Delta h \approx 2.9$ kPa, materially above the “early relief” regime generally sought for fibreglass uplift risk management.

The reported root cause is effective-area force imbalance: the wetted “head/rebate” region exposed to pool water can present a larger closing effective area than the opening effective area presented to groundwater below. In that case, actuation is governed by area-weighted hydrostatic force balance, not simply “upward pressure” versus “downward pressure”, and delayed opening is an expected outcome unless the valve geometry approaches a near-balanced effective-area ratio ($A_{open}/A_{close} \to 1$).

HydroPro is presented as a response to that mechanism: increasing the in-pool valve envelope (closer to long-established concrete-pool valve proportions) and adopting sealing/constraint features intended to achieve reliable low-threshold actuation (reported target: $\Delta h \approx 30$ mm, ≈ 0.29 kPa) while maintaining high relief capacity and dependable reseating once differential pressure equalises. This design rationale is complementary to—rather than a substitute for—drainage/standpipe architecture, noting that drainage can reduce exposure but cannot eliminate high ambient water-table scenarios.

The patent disclosure characterises opening sensitivity through an effective area ratio $R = A_{open} / A_{close}$. Where R approaches unity ($R \geq 0.9$; preferably ≥ 0.95 and most preferably > 0.97), the net opening force becomes responsive to small differential pressures because the opposing hydrostatic forces are nearly balanced [1]. In such a configuration, relatively small external head increases can overcome residual friction and constraint effects to initiate opening. This design intent directly targets delayed-opening failure modes associated with spring preload and small effective areas in conventional designs.

3.2 Flow capacity and the importance of relief rate

HydroPro reframes hydrostatic relief from a reactive plumbing accessory to a force-balanced pressure-control mechanism integrated at the structural level of the shell. The disclosures emphasise that hydrostatic protection is not solely an opening-threshold problem. Even when open, an inadequate flow path can throttle relief, allowing pressure to accumulate faster than it can be equalised. The patent describes a large flow path and an opening gap geometry intended to deliver relief flow rates of at least 150 L/min at differentials up to 150 mm water, with preferred embodiments at 300 L/min or higher and testing noted up to approximately 900 L/min in certain configurations [1].

3.3 Resealing behaviour and leakage risk

Following equalisation, the valve is described as returning to a sealed state, preventing ongoing loss of pool water once the hydrostatic event has passed [1]. The resealing function is supported by constraint-guided motion and a seal interface intended to be less sensitive to contamination than certain prior-art sealing approaches. Resealing performance should be treated as a design intent supported by disclosure and installation controls (Section 7), the independent comparative verification testing (Section 5), and further validation through a dedicated validation program (Section 9.2).

3.4 Product evolution note

Manufacturer communication indicates that shortly after release, a design refinement inverted the seal and V-wedge orientation to assist with more reliable reseating. This change is reported as not being reflected in certain cross-section diagrams in the patent materials. For technical clarity, this review distinguishes the patented functional concept (effective-area relationship, flow path, constraint-guided motion) from subsequent implementation refinements aimed at improving reseat robustness under field conditions.

4. Patent protection and protected technical concept

4.1 Patent protection

The HydroPro Valve incorporates technology protected by a family of international patents owned by MP Hydro Pty Ltd and licensed to Compass Pools Australia. Patent protection has been granted in Australia, the United States, New Zealand and multiple European jurisdictions following examination by the relevant patent authorities. These patents relate to the valve’s unique pressure-relief and sealing characteristics, which distinguish it from conventional hydrostatic relief valve designs.

4.2 Protected concept (functional essence)

Across the family, the protected technical concept is expressed functionally rather than as a single fixed geometry. The disclosures emphasise a pressure-responsive hydrostatic relief valve in which: (i) a movable sealing element experiences groundwater pressure over a defined effective opening area, (ii) pool water pressure acts over a defined effective closing area, and (iii) the ratio of these effective areas is engineered toward unity such that small differential pressures generate reliable opening. The design further discloses a flow path and opening gap geometry intended to provide substantial relief capacity at low head, together with constraint and sealing features intended to promote automatic resealing after equalisation [1,2].

5. Independent verification report

5.1 Foley comparative verification testing

The independent verification report prepared by Angus Foley, BEng (Hons I) (Mech), compared the HydroPro Valve with two commercially available hydrostatic relief valves sourced through normal industry supply channels and selected as representative examples of commonly used industry designs. The testing assessed activation opening and closing head differential, flow rate, and resealing performance using a controlled experimental apparatus at the Compass Pools Australia manufacturing facility. Although the apparatus was developed by Compass Pools Australia, Foley states that he independently reviewed, assessed and reported the testing outcomes, assisted in conducting the tests, and directly observed the procedure [7].

5.2 Measured performance outcomes

Under the tested conditions, the HydroPro Valve opened at an average differential head of approximately 23 mm and closed at approximately 7 mm. The comparison valves opened at approximately 290 mm. The HydroPro Valve also achieved an average flow rate of approximately 375 mL/s, compared with approximately 30 mL/s and 20 mL/s for the two comparison valves, and demonstrated consistent resealing under both positive and reverse head conditions. These results provide measured support for the engineering proposition that activation threshold, flow capacity and resealing behaviour must be considered together when assessing hydrostatic relief performance [7].

6. Independent engineering opinion

6.1 Rickard Engineering review

In an independent engineering review of the testing results, Charles Rickard, FIEAust, FIStructE, CEng, MIPENZ, NPR3-73285, Managing Director of Rickard Engineering, concluded that the measured performance differences were material from an engineering perspective and supported the proposition that the HydroPro Valve provides a more responsive and effective hydrostatic pressure relief mechanism than conventional valve designs [8].

6.2 Engineering benchmark and disclosure

Rickard also identified an activation differential head of approximately 30 mm as a desirable engineering benchmark for hydrostatic relief valve activation, noting the objective of providing early pressure relief before significant hydrostatic loading develops within the pool structure. His opinion records that the HydroPro Valve achieved activation at a differential head consistent with that benchmark, while the comparison valves required substantially greater differential pressure before activation. Rickard's letter also discloses that he is named as a co-inventor on the HydroPro patent, assigned any ownership rights, and does not receive royalties or other financial benefits from manufacture or sale of the valve [8].

7. System architecture and installation interface (Installation Manual)

7.1 HydroPro as an installed system

The Hydrostatic Valve Installation Manual indicates that HydroPro is deployed as part of a subshell drainage and standpipe system. The manual includes an engineering drawing extract showing a hydro sump and standpipe arrangement integrated with free-draining bedding and vented to atmosphere. This architecture is significant because it standardises the hydraulic communication between groundwater pathways and the valve approach zone, reducing the risk that site conditions isolate the valve from the pressure regime it is intended to relieve [6].

As an integrated, built-in unit, HydroPro enables a closer design and quality-control linkage between the relief device and the shell system, including controlled mounting geometry and repeatable assembly checks prior to delivery, rather than relying entirely on component-only installation in highly variable site conditions. In operation, the pool water volume provides immediate internal hydrostatic counter-pressure (and stabilising mass) against uplift, and the valve is exposed to submerged conditions as soon as the pool is filled. This provides an in-situ commissioning and functional assurance process that allows confirmation of installation integrity, sealing performance and operational readiness under representative wet conditions, complementing the independent comparative performance testing described elsewhere in this review.

7.2 Bedding media, geofabric usage, and fines management

The manual specifies installation requirements that vary with bedding type. For sand or crusher-dust bedding, a geofabric section is required; for no-fines bedding, geofabric is stated as not required. Drainage trench formation and use of drainage media are prescribed to promote permeability and to limit fine migration into critical interfaces. These controls directly target common root causes of hydrostatic valve underperformance: blocked approach flow, fines-induced binding, and loss of hydraulic connectivity [6].

7.3 Assembly controls relevant to seal integrity and mechanical freedom

The manual contains explicit workmanship controls: lubrication of O-rings, careful sealant application at the body-to-mount interface, avoidance of over-tightening, and verification of free operation after assembly. The manual further directs that fasteners are to be tensioned with hand tools and not with an electric drill. These controls reduce the likelihood of installation-induced distortion, thread damage, and seal-face contamination, all of which can compromise resealing reliability [6].

7.4 Commissioning controls

The manual describes a commissioning approach in which a temporary mass (for example, a bucket of gravel) is used to hold the valve closed during initial filling until the pool water level reaches an appropriate stage, after which the standpipe connection is completed. This procedure manages initial conditions and reduces nuisance opening during construction-phase water level changes [6].

8. Comparative technical discussion

8.1 Opening threshold behaviour

Conventional spring-loaded disc and O-ring valves are susceptible to delayed opening where spring preload, friction, or contamination dominate the actuation force balance. The HydroPro disclosure targets earlier opening by engineering the effective areas toward unity, thereby increasing responsiveness to small differential pressures. This approach is conceptually aligned with the standard threshold referenced in the patent background (approximately 30 mm water head), though independent opening-distribution testing is required to confirm population performance [1].

From a risk perspective, many traditional hydrostatic valves are specified and evaluated as standalone components (often by third-party vendors) with testing that may not replicate submerged, pressure-cycled service conditions once installed into a fibreglass shell. Because component supply, shell manufacture, and site installation are commonly separated, the valve-to-shell interface becomes a dominant source of variability: small differences in sealant application, tightening torque, alignment, and contamination control can materially shift opening threshold and reseat/leakage behaviour.

In addition to spring preload, static friction at the seal interface (‘stiction’) can elevate effective opening thresholds beyond nominal design intent. Where seal-face adhesion must be overcome before motion begins, the observed opening head may exceed specification, particularly under debris-contaminated or pressure-cycled conditions.

8.2 Relief capacity under rapid groundwater rise and user intervention

Relief capacity is critical during rapid groundwater rise events and in situations where pool water may be pumped down during rainfall. The disclosed large flow path and opening gap geometry are intended to support substantially higher relief flow than narrow-gap, small-body valves. In comparative terms, this addresses a key failure mode described in the patent background: valves that open but cannot relieve at a rate sufficient to prevent damaging uplift loads from developing [1].

In fibreglass shells, the most damaging conditions are often transient: rapid groundwater rise during storms, localised seepage pathways, and construction or renovation activities that temporarily reduce internal water level can create unsteady (hydrodynamic) head conditions where differential pressure increases faster than the system can equilibrate. Under these scenarios, a low-loss flow path and high relief rate reduce the time constant of equalisation, limiting peak differential loads that drive bulging, laminate cracking, and secondary stresses at penetrations and connected pipework.

8.3 Reseating reliability, leakage, and serviceability

Grease plate valves are described as requiring diver intervention after operation, while small spring-loaded valves can suffer from leakage and reseat problems. HydroPro is disclosed as being constraint-guided to reseat automatically and includes seal and assembly controls aimed at preserving seal integrity. Loss of internal water level following incomplete reseating reduces internal counter-pressure and stabilising mass, increasing vulnerability to subsequent hydrostatic events.

The reported post-release seal and V-wedge inversion is consistent with an engineering focus on reseat robustness. Independent leak-rate and reseat hysteresis testing would provide the most direct comparative evidence [1,6].

8.4 Systemisation as a differentiator

A practical differentiator evident in the installation documentation is systemisation: the manual prescribes subshell drainage, bedding, venting, and workmanship controls to standardise the field hydraulic environment. Many marketplace hydrostatic solutions are installed as component-only devices in highly variable site conditions.

The system interface specified in the manual reduces variability in approach flow and venting, which are common determinants of whether any valve can function as intended during a hydrostatic event [6].

HydroPro's integration into the shell and its prescribed sump/standpipe architecture also couples relief behaviour to the pool's internal water column. The pool water volume provides a predictable internal closing head and stabilising mass against uplift, while the engineered approach zone promotes rapid pressure communication to the valve. Practically, this reduces reliance on ad hoc component-only fitment and may reduce susceptibility to post-installation disturbance (for example, renovation works, temporary dewatering, or plumbing alterations) that can compromise discrete valves and their seals.

9. Evidence base and field performance claims

9.1 Manufacturer-reported field performance

Manufacturer and installer experience indicates that over approximately 10 years of field use there have been no reported hydrostatic structural failures (for example, shell shift, uplift, or cracking) in fibreglass pools fitted with the HydroPro system. In the context of an engineering technical journal, this statement should be treated as manufacturer and installer-reported field evidence until supported by an auditable dataset describing installed population size, site exposure conditions, definition of hydrostatic failure, and claims verification methods.

9.2 Proposed verification pathway (recommended for publication-grade substantiation)

To substantiate performance claims to engineering journal standards, a staged validation program remains recommended: (i) bench testing of opening and closing head distributions across multiple samples, including debris challenges; (ii) controlled flow testing to obtain Q versus Δh curves; (iii) fouling and cycle testing to assess binding and seal wear; and (iv) retrospective field auditing across an identified installed population with exposure mapping and third-party record triangulation. The extracted design parameters and the independent comparative testing results provide a direct basis for defining future test acceptance criteria.

10. Limitations

This manuscript remains limited by the scope of the documentation and test material reviewed. Patent disclosures describe intended function and may include representative test statements, but they do not substitute for population-level performance distributions across manufacturing variability and site conditions. The Foley report provides controlled comparative verification testing of specific valve samples; it does not constitute product certification or statistical certification of all production units. Further work remains desirable across debris exposure, fouling tolerance, long-term cycling, groundwater conditions, installation variability and retrospective field auditing. The installation manual provides meaningful system context, but does not by itself quantify performance outcomes across the installed population.

11. Conclusions

On the basis of the granted patent disclosures and installation documentation reviewed, HydroPro presents a coherent engineering approach to hydrostatic uplift risk management in fibreglass pools. The near-balanced effective-area design targets early opening under small differential pressures, while the disclosed flow path and opening geometry target high relief capacity at low head. Installation documentation demonstrates system-level controls over drainage architecture, approach flow, venting, and assembly practices, reducing common site and workmanship failure modes. Manufacturer and installer - reported decade-scale field performance is a potentially strong outcome indicator, but it warrants transparent audit and independent validation to support journal-grade conclusions.

Where a failure mode is mechanically eliminated rather than merely resisted, warranty positions become technically more defensible. While patents do not of themselves create warranties, they can materially strengthen the technical defensibility of a warranty position when the disclosed operating principle is aligned with a verifiable installation architecture and supporting performance evidence. In that context, the disclosed HydroPro mechanism and its systemisation are consistent with Compass Pools Australia's stated ability to offer a Lifetime Hydrostatic Warranty, noting that such positions have historically been uncommon in the fibreglass pool sector where hydrostatic damage has often been excluded. With residential pool installations commonly representing investments in the many tens of thousands of dollars, it is incumbent on manufacturers to undertake testing that seeks to minimise the likelihood of structural compromise to shell walls, floors, and connected pipework during foreseeable events such as partial draining, elevated water tables, intense rainfall, flooding, and renovation or repair activities.

In the absence of a prescriptive Australian Standard or equivalent code pathway for hydrostatic valve verification and based on the disclosed design intent and system-level installation architecture reviewed, HydroPro presents strong indicators of a comparatively superior approach to managing hydrostatic and hydrodynamic pressure impacts on fibreglass pool shells; however, definitive performance ranking remains dependent on transparent field auditing and independent validation.

Acknowledgements

The author acknowledges technical clarifications provided by Compass Pools personnel to reduce factual error in the description of product evolution. The analysis framework and conclusions remain the responsibility of the author.

Declarations and Data availability

This review is based on publicly available granted patent specifications, the Hydrostatic Valve Installation Manual (Version 8, dated 23 February 2022), the Foley comparative verification testing report and the Rickard Engineering opinion letter. No de-identified warranty-claims dataset was available to the author at the time of drafting.

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Competing interests and independence

The author, Spiros Dassakis, is Principal of NextGen Experts. HydroPro is owned by MP Hydro Pty Ltd and manufactured by Compass Pools Australia. Independent verification testing undertaken by Angus Foley is addressed separately in this review. Charles Rickard's co-inventor disclosure is addressed in Section 6. Manufacturer-provided technical clarifications were considered only to reduce factual error. The author retained responsibility for the analysis, interpretation and conclusions.

Author contributions

Spiros Dassakis (NextGen Experts): conceptualisation; document review and analysis; synthesis; manuscript drafting; proposed validation framework.

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[5] EP 2853658 B1 (European patent; local validations).
[6] Compass Pools Australia, Hydrostatic Valve Installation Manual, Version 8, 23 February 2022.
[7] Foley, A. (2026), Hydrostatic Pressure Relief Valve Comparative Verification Testing.
[8] Rickard, C. (2026), HydroPro Hydrostatic Relief Valves - Engineering Opinion.

Enclosures:

1. *Foley, A. (2026), Hydrostatic Pressure Relief Valve Comparative Verification Testing.*
2. *Rickard, C. (2026), HydroPro Hydrostatic Relief Valves – Engineering Opinion.*

Appendix A. Patent family overview

Jurisdiction	Application No.	Patent No.
Australia	2017201088	2017201088
Australia	2014210652	2014210652
Germany (validation of EP 2853658)	-	60 2014 064 422.8
Spain (validation of EP 2853658)	-	2853658
France (validation of EP 2853658)	-	2853658
United Kingdom (validation of EP 2853658)	-	2853658
Italy (validation of EP 2853658)	-	502020000070012
New Zealand	627191	627191
New Zealand	626154	626154
Slovak Republic (validation of EP 2853658)	-	2853658
USA	14/466,023	9,845,608

2026

Hydrostatic Pressure Relief Valve Comparative Verification Testing

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Independent Technical Testing & Reporting

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Executive Summary

The following report outlines the performance of several commonly used hydrostatic pressure relief valves and the HydroPro Valve, which is protected by patents owned by MP Hydro Pty Ltd and licensed to Compass Pools Australia (CPA). The purpose of this testing was to independently verify whether the HydroPro Valve demonstrates materially different performance characteristics from commonly used hydrostatic relief valves under controlled test conditions. These valves were tested on an experimental rig developed by the R&D team at CPA, which is detailed in full in this report. The valves were tested to determine opening and closing head differential pressure, flow rate, as well as resealing performance after opening. Under the tested conditions, the HydroPro Valve demonstrated lower activation head, higher flow capacity and more consistent resealing performance than the two comparison valves.

1. Introduction

Hydrostatic relief valves are critical components in swimming pool systems, designed to relieve groundwater pressure acting on pool structures to minimise uplift or shell deformation. Proper valve performance ensures structural integrity by allowing water ingress when external hydrostatic pressure exceeds internal pressure. These events are particularly common during high rainfall and flooding events, or when a pool is being drained.

Hydrostatic relief valves typically consist of a spring-loaded sealing mechanism. Under normal operating conditions, the internal pool water pressure, combined with the spring force, maintains the valve in a closed position. When external groundwater pressure exceeds the internal pressure and spring resistance, a pressure differential is created that forces the valve to open, allowing groundwater to enter the pool and relieve the external load. As the pressure differential reduces, the spring assists in reseating the valve to prevent reverse flow.

This report evaluates the performance of two in-floor hydrostatic relief valves, commonly used in industry and the HydroPro Valve (protected by patents owned by MP Hydro Pty Ltd and licensed to Compass Pools Australia (CPA)), focusing on:

- **Activation (opening and closing) hydraulic head differential pressure**, defined as the external water level relative to the pool required to initiate valve opening, and the corresponding level at which the valve reseats during decreasing external pressure. This parameter characterises the sensitivity of the valve to pressure changes and its ability to respond to hydrostatic loading conditions.
- **Flow rate characteristics**, representing the rate at which water enters the pool once the valve has opened. This provides an indication of the valve's capacity to relieve external pressure and is influenced by valve geometry, opening displacement, and the applied head differential.
- **Resealing (closing) performance**, which assesses the ability of the valve to fully reseat and prevent leakage once the pressure differential is reduced or reversed. This is critical to ensure that the valve does not allow unintended water exchange under normal operating conditions.

1.1 Scope and Limitations

This report presents comparative testing of the HydroPro Valve against two commonly used hydrostatic pressure relief valves under controlled experimental conditions. The testing focused on valve activation head differential, flow rate, and resealing performance using the CPA testing apparatus described in this report. The results presented are specific to the tested valve samples, test setup, and test conditions. Performance may vary under different installation conditions, long-term service conditions, debris exposure, groundwater conditions, or variations in valve manufacture and installation. This report does not constitute product certification or compliance testing against a nominated Australian Standard, unless otherwise stated. The results should be interpreted as comparative verification testing of the specific valve samples tested, rather than statistical certification of all production units.

2. Experimental Setup

2.1 Valves Tested

To assess the efficacy of the HydroPro valve, it was compared against two common valves. The comparison valves were commercially available hydrostatic relief valves sourced through normal industry supply channels and selected as representative examples of commonly used industry designs. The HydroPro valve, denoted as HP, has a nominal diameter of 150 mm and an opening distance of approximately 8 mm. The other two commonly used valves, herein referred to as V1 and V2, each have nominal diameters of 50 mm and opening distances of approximately 3.5 mm. Figure 1 depicts the open and closed state of the HP and a similar commercially available valve, as V1 and V2 had already been installed into the testing apparatus outlined in the following section.

Figure 1 TOP: HydroPro Valve; closed and open position. BOTTOM: Commercially available valve; closed and open position.

2.2 Testing Procedure

The testing apparatus, outlined in Figure 2, located at the CPA Manufacturing Facility, Australia, was used to perform tests on three valves. This apparatus was fitted to an above ground pool, with a fillable depth of approximately 1.5 m. Each valve was connected to an external upright pipe, used to replicate external groundwater. The large centre pipe was fitted to the HP valve to accommodate the larger diameter, whilst the two clear pipes to the right, were each fitted to V1 and V2, respectively. The two smaller pipes to the left of the large pipe were used to observe the internal pool water level and the HP external water level. Each pipe also contained a lower drain port to release water and lower the 'groundwater' pressure. Measuring devices were fitted to each of the internal and external pipes to record water levels during testing. Further schematics of the testing apparatus can be seen in Appendix A.

Figure 2 Experimental hydrostatic valve testing apparatus at CPA facility.

Although the test apparatus was developed by CPA and located at the CPA Manufacturing Facility, the author independently reviewed, assessed and reported the testing outcomes. The author also assisted in conducting the tests and observed the test procedure directly. The findings and conclusions presented in this report are based on the measured test data, direct observations made during testing, and an independent assessment of the results.

2.2.1 Activation (Open) Hydraulic Head Differential Pressure

To determine the opening and closing hydraulic head differential pressure, each pipe and valve was filled and tested independently by filling at a constant flow rate until valve activation occurred. At this point, inflow through the pipe balanced outflow into the pool. The water level at which the valve opened was recorded, referred to as the opening hydraulic head differential, once steady-state conditions were achieved.

2.2.2 Flow Rate and Activation (Close) Hydraulic Head Differential Pressure

To assess the allowable external groundwater inflow rate to the pool, the filling process was then ceased and both time and water level were recorded. After a measurable decrease in external water level, a second set of time and level measurements was taken, which would indicate the allowable flow rate of the valve. As the water level continued to decline, the valve eventually closed, terminating flow between the external pipe and the pool. The corresponding water level at closure, referred to as the closing hydraulic head differential, was recorded.

2.2.3 Resealing Performance

A final test conducted on all three valves assessed resealing performance. Due to the small diameters of the valves, particularly V1 and V2, it can be difficult to visually confirm whether the valve has fully seated or remains partially open due to debris or a faulty spring mechanism.

Once the valve was considered, visually, to have reseated, the external water level and time were recorded. If the valve had not fully sealed, the external water level would continue to decrease until equilibrium with the internal pool level was reached. Any subsequent change in water level was recorded to identify potential leakage.

Where no change in water level was observed, indicating effective sealing, the external groundwater level was further reduced (to 50 mm lower than the internal water level) using the drain to increase the internal pressure differential. This was done to confirm that the valve remained sealed under higher reverse head conditions. Any observed increase in external water level, or corresponding decrease in internal water level, was taken to indicate incomplete resealing of the valve.

2.3 Measurement Uncertainty

Head height measurements were obtained using a metric ruler (±1.0 mm resolution) with a spirit level (verified with from-ground measurements) to maintain vertical alignment. This manual approach introduces greater observational uncertainty compared to digital instrumentation; however, variability across repeated trials was quantified using standard deviation. Reported error bars correspond to ±1 standard deviation.

3. Results

This section presents the results of the hydraulic differential head pressure and flow characterisation testing. The opening head, or hydraulic head differential, was defined as the difference between the external water level and the internal pool water level required to initiate valve activation, while the closing head, or hydraulic differential pressure corresponded to the level at which the valve reseated during a decreasing external water level. Flow rates into the pool were recorded as a function of external water level during this transition. Valve performance at equilibrium conditions and during forced closure was also assessed to confirm consistent reseating behaviour.

For ease of presenting results, the activation, both open and close, differential head pressures are presented in Section 3.1.

3.1 Activation Hydraulic Head Differential Pressure

The measured valve open and closing activation head differentials for each valve are presented in Figure 3. The data presented are the average values across three tests on each valve.

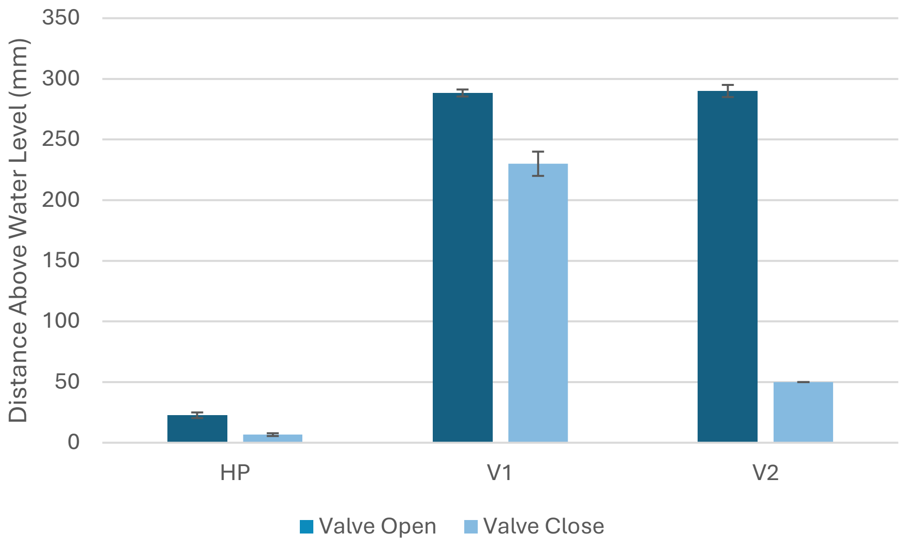

Figure 3 Hydraulic head differentials required for valve activation (opening) and reseating (closing) for each valve configuration. Head is reported as the external water level relative to the pool level (mm). Error bars represent ±1 standard deviation.

As shown in Figure 3, the HP valve exhibited substantially lower opening and closing head heights compared to V1 and V2, with average values of 23 mm and 7 mm, respectively. V1 and V2 demonstrated similar opening head heights of approximately 290 mm. However, the closing head differed considerably between the two, with V1 closing at an external head of approximately 230 mm above the pool water level, while V2 closed at approximately 50 mm.

3.2 Flow Rate

The measured flow rates for each valve are presented below in Figure 4. The data presented are the average values across three tests on each valve.

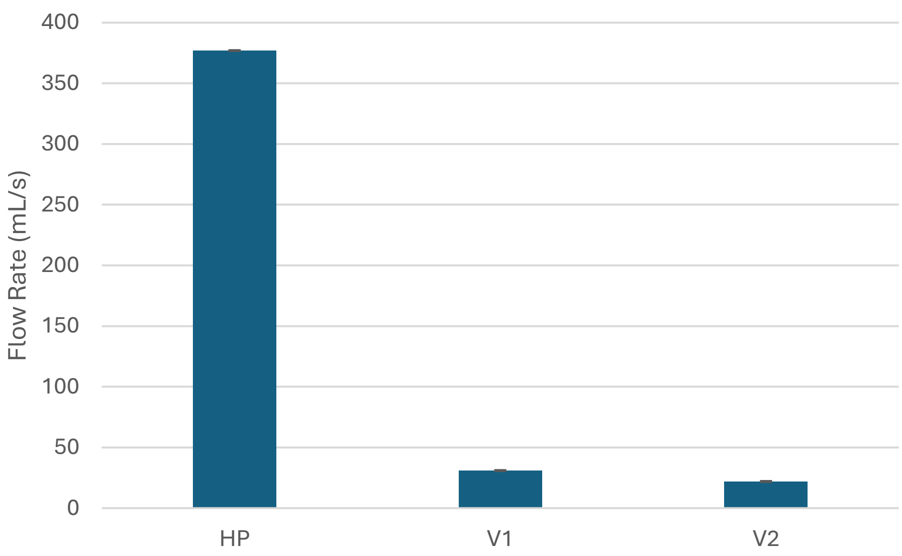

Figure 4 Average inflow rates to the pool for each valve configuration (HP, V1, V2), with variability shown as ±1 standard deviation.

It can be observed from Figure 4, the HP valve exhibited a substantially higher average flow rate (~375 mL/s) compared to V1 (~30 mL/s) and V2 (~20 mL/s), which showed relatively low and similar flow capacities. It is noted that the HP valve operated at a reduced peak head differential (~24 mm), whereas V1 and V2 reached peak head differentials of approximately 290 mm.

3.3 Resealing Performance

The resealing performance of each valve was assessed under two conditions: with the external water level greater than the internal pool level, and with the external water level reduced to 50 mm below the internal level. Observations were made during two of the three tests, with consistent findings. The results are outlined in Table 1.

Table 1 Resealing Performance Under Positive and Reverse Head Conditions

Valve	External > Internal	Leakage Observed	External < Internal	Leakage Observed	Notes
HP	Sealed	None	Sealed	None	Stable under both conditions
V1	Not fully sealed	~40 mm drop in 5 min	Sealed	None	Resealed under reverse head
V2	Sealed	None	Not sealed	~50 mm rise in ~1 min	Rapid leakage to equilibrium

As summarised in Table 1, the HP valve achieved consistent sealing under both test conditions, with no measurable change in water level over time. V1 exhibited initial leakage when the external water level exceeded the internal level but resealed effectively once a reverse head differential was applied. In contrast, V2 initially sealed under positive external head, however, failed to maintain sealing under reverse head conditions, where it rapidly equalised with the internal water pressure.

3.4 Results Summary

A summary of the key performance results for each valve is provided in Table 2. Overall, the HP valve activated at a substantially lower hydraulic head differential than V1 and V2, while also achieving the highest measured flow rate. The HP valve also demonstrated consistent resealing under both positive and reverse head conditions. In comparison, V1 and V2 exhibited higher activation thresholds, lower flow rates, and inconsistent resealing performance under at least one test condition.

Table 2 Summary of Valve Performance Under Tested Conditions

Valve	Opening Head Differential (mm)	Closing Head Differential (mm)	Average Flow Rate (mL/s)	Resealing Performance
HP	23	7	375	Sealed under both positive and reverse head conditions
V1	290	230	30	Leakage observed under positive external head; sealed under reverse head
V2	290	50	20	Sealed under positive external head; leakage observed under reverse head

4. Discussion

The results demonstrate clear differences in performance between the HP, V1 and V2 valves, across all three test categories: activation head, flow capacity, and resealing behaviour.

The HP valve exhibited substantially lower opening and closing hydraulic head differentials compared to both V1 and V2. This indicates an increased sensitivity to external pressure changes, allowing the valve to activate under relatively small hydrostatic loads. In contrast, V1 and V2 required considerably higher external head differentials (~290 mm) to initiate opening, suggesting a delayed response to increasing groundwater pressure. From an engineering perspective, this may reduce the effectiveness of these valves in preventing uplift or structural loading under rapidly changing groundwater conditions.

Flow rate results further reinforced these differences. Despite operating under a much lower head differential, the HP valve delivered materially higher inflow rates than both V1 and V2. This suggests that the HP valve provides a more efficient pressure relief mechanism, enabling rapid equalisation between external and internal pressures. In comparison, the relatively low flow capacities observed for V1 and V2 indicate a limited ability to relieve hydrostatic pressure once activated, which may prolong exposure to elevated external loads.

Resealing performance also varied notably between the valves. The HP valve demonstrated consistent and stable sealing under both positive and reverse head conditions, indicating reliable operation across varying pressure regimes. V1 showed partial sealing under positive external head, with observable leakage, but was able to reseal effectively once a reverse head differential was applied. This behaviour suggests sensitivity to pressure conditions and potential limitations in sealing reliability. V2, while initially sealing under positive head, failed to maintain sealing under reverse head conditions, with rapid leakage and equilibration observed. This indicates a reduced ability to prevent unintended water exchange once external pressure conditions change.

Overall, the results indicate that valve geometry and sealing design strongly influence hydrostatic relief performance. The HP valve combined a lower activation threshold with a higher flow capacity, suggesting that it can respond earlier to external hydrostatic loading while allowing faster pressure equalisation once opened. The differing resealing behaviour observed for V1 and V2 also highlights that activation performance alone is not sufficient to assess valve suitability, as reliable closure is required to prevent unintended water exchange under changing pressure conditions.

5. Conclusion

Under the tested conditions, the HydroPro valve demonstrated materially superior measured performance under the tested conditions. It operated at reduced head differentials while delivering higher flow rates, enabling more effective pressure relief. Additionally, it maintained consistent sealing under both positive and reverse head conditions. In comparison, the common, commercially available valves, V1 and V2 exhibited higher activation thresholds, lower flow capacities, and less reliable sealing behaviour. The results therefore verify that the HydroPro Valve exhibits materially different hydraulic performance characteristics to the tested comparison valves. These findings indicate that valve design plays a critical role in hydrostatic pressure management, with the HydroPro Valve offering improved performance for groundwater relief applications.

6. Appendix

6.1 CPA Testing Apparatus Schematics

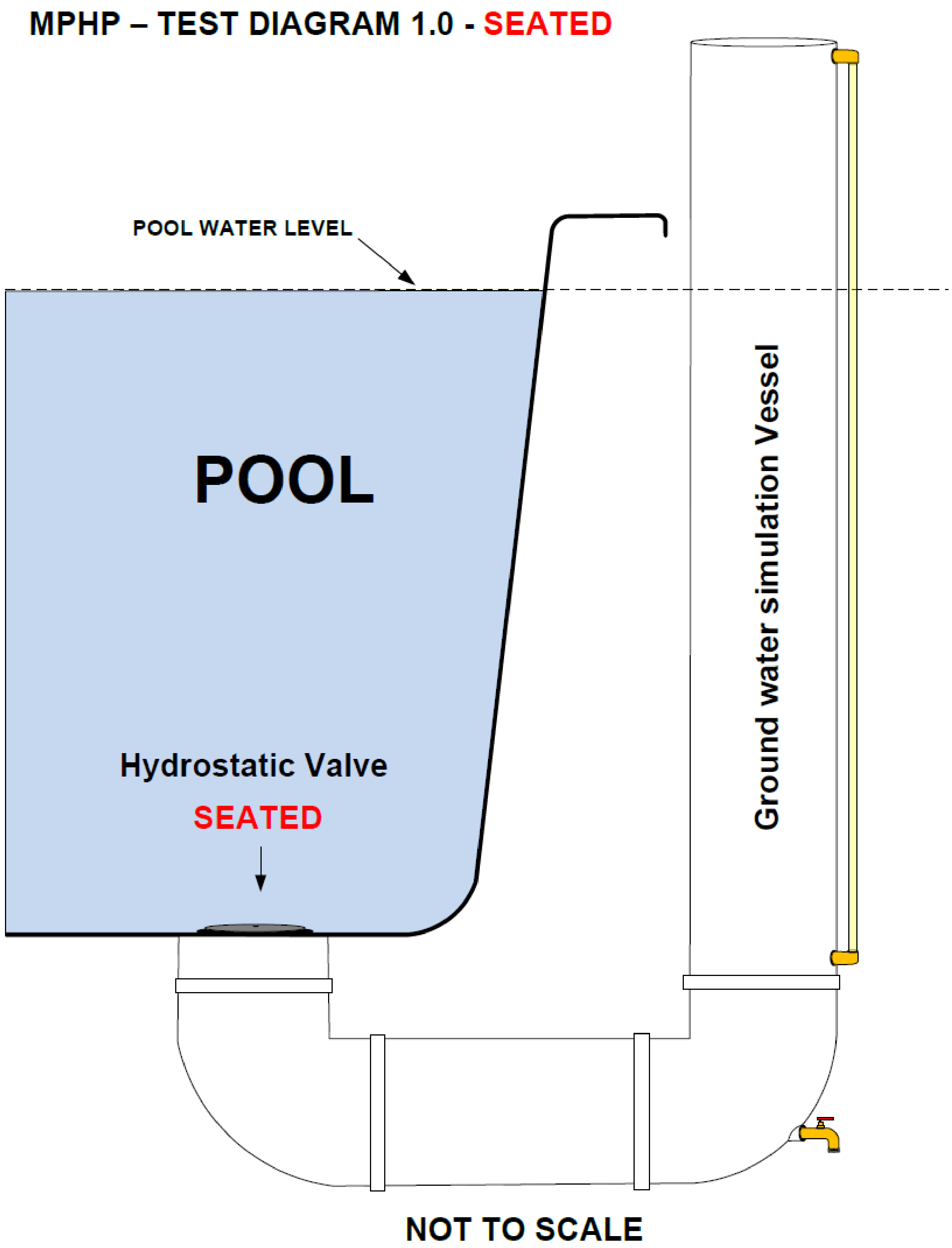

Figure 5 CPA testing apparatus schematic - seated valve.

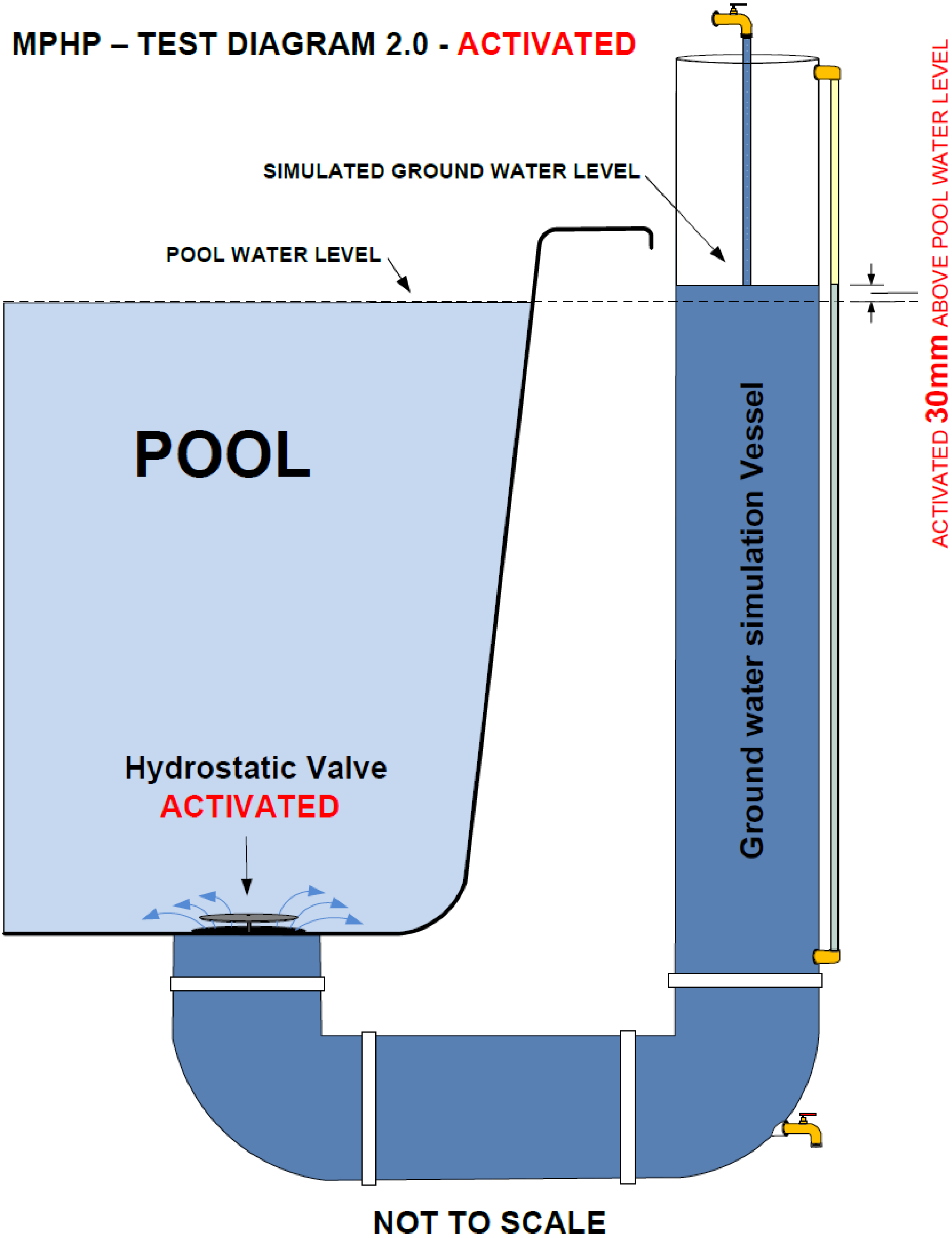

Figure 6 CPA testing apparatus schematic - activated valve.

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Reference number: 7010-R&D_260616
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Dear Anthony, Damien and Spiros

RE: HYDROPRO HYDROSTATIC RELIEF VALVES – ENGINEERING OPINION

I have reviewed the Hydrostatic Valve Testing Report prepared by Angus Foley, BEng (Hons I) (Mech), relating to the performance of the HydroPro hydrostatic relief valve and its comparison with representative industry-standard hydrostatic relief valves.

BACKGROUND

Hydrostatic pressure has long been recognised as one of the principal risks affecting fibreglass swimming pools. Where groundwater levels rise above the internal water level of a pool, hydrostatic pressure can impose significant uplift forces on the structure. Hydrostatic relief valves are intended to provide a means of equalising pressure by allowing groundwater to enter the pool when external pressure exceeds internal pressure.

Throughout my involvement in the fibreglass swimming pool industry, including participation in the development and review of Australian Standards relating to fibreglass swimming pools, I have observed the importance of both effective drainage systems and reliable hydrostatic relief valves in mitigating hydrostatic pressure risks.

While installation practices and drainage requirements have improved significantly over recent decades, the effectiveness of the hydrostatic relief valve itself remains a critical component of the overall protection system.

ENGINEERING PERFORMANCE BENCHMARK

In my professional opinion, a differential head of approximately 30 mm represents a desirable engineering benchmark for hydrostatic relief valve activation.

This benchmark is based on historic industry practice and the objective of providing early pressure relief before significant hydrostatic loading develops within the pool structure, whilst avoiding unnecessary or nuisance activation of the valve.

REVIEW OF TESTING RESULTS
The testing undertaken by Compass Pools Australia and documented by Angus Foley compared the HydroPro valve with representative industry-standard hydrostatic relief valves.

The reported results demonstrated that:

- The HydroPro valve activated at an average differential head of approximately 23 mm.
- The comparison valves activated at differential heads of approximately 290 mm.
- The HydroPro valve achieved substantially greater flow capacity following activation.
- The HydroPro valve demonstrated reliable resealing performance following pressure equalisation.

The comparison valves exhibited less favourable activation and/or resealing characteristics.

Most significantly, the HydroPro valve achieved activation at a differential head consistent with the approximately 30 mm engineering benchmark discussed above, whereas the comparison valves required substantially greater differential pressure before activation occurred.

FIELD PERFORMANCE
Based on information provided by Compass Pools Australia, the HydroPro valve has been installed in more than 17,000 swimming pools since its introduction in 2014.

Compass Pools Australia is not aware of any instance where a HydroPro valve malfunction has been identified as the cause of hydrostatic pool damage.

DISCLOSURE
Charles Rickard is named as a co-inventor on the HydroPro hydrostatic relief valve patent. Mr Rickard assigned any ownership rights associated with the patent and does not receive royalties or other financial benefits arising from the manufacture or sale of the HydroPro valve.

The opinions expressed in this letter are provided in his capacity as a professional engineer based on his experience in fibreglass pool engineering and his review of the testing results referenced herein.

ENGINEERING OPINION
Having reviewed the testing results and considered them in the context of my experience in fibreglass pool engineering, it is my opinion that:

1. The HydroPro valve demonstrates activation sensitivity substantially superior to the representative industry-standard valves assessed.
2. The HydroPro valve provides significantly greater pressure-relief capacity once activated.
3. The HydroPro valve exhibits reliable resealing characteristics following operation.
4. The HydroPro valve satisfies a desirable engineering activation benchmark of approximately 30 mm differential head.

5. The combination of laboratory testing and long-term field performance provides strong evidence of the effectiveness of the HydroPro valve in managing hydrostatic pressure risks in fibreglass swimming pools.

Yours faithfully

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