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NATSPEC for refurbishment, retrofitting and adaptive re-use

This TECHreport outlines how the NATSPEC specification system may be used for refurbishment, retrofit and adaptive re-use projects. Key upgrade options are summarised and refurbishment related items in NATSPEC worksections are highlighted.

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NATSPEC FOR REFURBISHMENT, RETROFITTING AND ADAPTIVE RE-USE

1 INTRODUCTION

1.1 NATSPEC and refurbishment

Specifications are essentially written descriptions of the required quality of the built product and its component products. In this respect, specifying a refurbishment or adaptive re-use project is no different from specifying a new build project. This TECHreport outlines how a NATSPEC based specification may be used for refurbishment and adaptive re-use projects by highlighting the appropriate worksections for various upgrade options.

1.2 Definitions

The terms refurbishment, retrofit, and adaptive re-use are related, yet each has a different focus.

- Refurbishment: The remodelling, refashioning and general renovation of a building, site, product or infrastructure.¹
- Retrofit: The process of modifying a building's systems or structure after it is initially built and occupied.²
- Adaptive re-use: A process that changes a disused or ineffective item into a new item that may be used for a different purpose.³

1.3 Reasons for building refurbishment

Refurbishment is usually undertaken to:

- Replace deteriorated finishes and building components.
- Reorganise spaces for new uses.
- Improve environmental quality.
- Achieve code compliance and improve safety.

1.4 Levels of refurbishment

Refurbishment may be broadly grouped into three levels:

- Minor:
 - Building tune up and aesthetics.
 - Minor repairs to building services.
 - Non-tenancy upgrades in sanitary facilities and common areas.
- Major:
 - Central plant upgrade or replacement.
 - Tenancy upgrades including sanitary facilities and common areas.
 - Technology upgrades, such as lighting and air conditioning. May involve alterations to risers, walls and replacement of ceilings.
 - Facade upgrade.
 - Roof upgrade.
- Total:
 - Strip back to base building structure.
 - Removal of all building services.
 - Replacement of all building services with new technologies.⁴
 - Facade replacement.
 - Roof replacement.



Goods Shed North, Melbourne. Elenberg Fraser, BVN 2009. Adaptive re-use of the heritage listed former 1890 railway goods building to offices with a 5 Star Green Star design rating.





Tate Modern, London Herzog & de Meuron, 2000. Adaptive re-use of the 20th century Bankside Power Station to the Tate Modern art gallery.

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2 DESIGN ISSUES

Some of the main issues for refurbishment, retrofit or adaptive re-use projects include: • NCC compliance:

- Accessibility and fire safety system improvements to enhance building useability and safety.
- Sustainability and ESD:

Building systems and building fabric upgrades to create a more sustainable, energy efficient structure and improve a building's energy efficiency rating.

- Change of use: Retention and re-use of existing buildings to conserve their embodied energy, and reduce energy usage associated with demolition, waste disposal and new construction. Maintain heritage significance, where applicable, through reversible design insertions and sensitively designed new work.
- Demolition: Removal of hazardous materials and protection of retained fabric. Address sustainability through material re-use and recycling.

3 KEY UPGRADE OPPORTUNITIES

3.1 Overview

Refurbishing provides an opportunity to improve a building's environmental performance, increase occupant comfort and reduce running costs.

This TECHreport focuses on upgrade opportunities in the following areas:

- Demolition.
- Structure.
- Facade improvement.
- Accessibility.
- Mechanical services.
- On-site power generation.
- Water conservation.
- Fire safety.
- Lighting.

3.2 Demolition

A key part of sustainable refurbishment is planning and undertaking demolition in a way that reduces waste and encourages material re-use and recycling. The **DEMOLISHED MATERIALS** and **DEMOLITION** clauses in 0201 Demolition and 0202 Demolition (interior and alterations) can be used to specify demolished materials to be diverted for re-use or recycling. Material re-use and recycling can also be specified in the **WASTE MANAGEMENT** clause of 0172 Environmental management. Salvage for re-use is also covered in 0530 Suspended ceilings – combined, which has options for scheduling demountability. The re-use of recovered hardware can be documented in the **SUBMISSIONS** clause in 0455 Door hardware. The **PROTECTION** clauses in 0201 Demolition and 0202 Demolition (interior and alterations) can be used to specify weather and dust protection for existing plant, equipment and materials intended for re-use. Re-use of building service components is covered in the **DEMOLITION – BUILDING SERVICES** clause in 0201 Demolition.

3.3 Structure

Base building structural modifications may be required for refurbishment and/or change of use projects to increase or reconfigure usable floor space, improve fire protection, strengthen the existing structure, or as a result of other modifications such as new stairs or lifts.

Strengthening may be required when the existing structure is no longer adequate due to change of use and new loading, or changes in design standards. Strengthening options include replacement framing, supplementary framing, or strengthening the existing framing.

For residential buildings, retrofitting the structure to include new balconies is a popular way to add useable space. Atrium spaces may be cut through existing floors to improve daylight penetration and ventilation for deep floor plates.



55 Baker Street, London. *Make, 2008* Adaptive re-use of the 1950s office buildings, former headquarters of Marks & Spencer, into a mixed use office, retail, leisure and residential complex. BREEAM rating of 'Excellent'.





Perth Town Hall Cox Howlett + Bailey Woodland & Hocking Planning and Architecture, 2005 Staged refurbishment and restoration of heritage listed 1870s building, including services and access upgrade.

2

Performance requirements may be specified in worksections such as 0310 Concrete – combined or in the detailed concrete series 0311 Concrete formwork to 0321 Precast concrete. 0341 Structural steelwork and 0381 Structural timber may also be used to specify structural modifications, and changes to load bearing masonry can be specified in 0331 Brick and block construction, 0334 Block construction or 0335 Brick construction.

3.4 Facade improvement

Facade upgrades can both improve a building's environmental performance and assist to reposition the building in the marketplace. New facades will need to comply with BCA Section J Energy efficiency provisions, and existing building facades may need to be upgraded to comply if required by State or Territory legislation.

Strategies for improving the performance of an existing facade include the following: • Applying solar control film.

- Resealing existing windows.
- Reglazing existing windows with high performance glass.

These options may be specified in 0461 Glazing. Other strategies to reduce heat gain include:

- Providing automated internal blinds.
- Installing an additional panel of glazing to the internal face of the facade.
- · Shading windows externally.

0574 Window coverings, 0461 Glazing, 0432 Curtain walls and 0457 External screens have provisions for specifying the above options. Site reglazing for refurbishment works is covered in the **SITE REGLAZING** clause in 0462 Structural silicone glazing. Improvements to the existing curtain wall such as resealing and improving spandrel panel insulation through to replacing the entire facade may be covered in 0432 Curtain walls.

3.5 Accessibility

The Commonwealth's *Disability (Access to Premises - Buildings) Standards* introduced in March 2010 and incorporated into the National Construction Code (NCC) in May 2011, resulted in changes to requirements for accessibility in and around buildings. The Premises Standards are triggered in the Building Code of Australia (BCA) for new Class 1b, 3, 5, 6, 7, 8, 9 and 10 buildings, or those undergoing refurbishment work that requires building approval. Class 2 buildings are excluded from this Standard except where accommodation for short-term rent is provided, although BCA Section D has further requirements for Class 2 buildings. Both new work and affected portions of the existing building need to comply to the Standard. Compliance issues include:

• Doorways:

Options include modifying existing doors such as changing door swings and replacing door hardware, widening existing doorways or installing alternative compliant doors to meet the access code requirements in AS 1428.1 and AS 1428.2. *0453 Doors and access panels* and *0455 Door hardware* may be used to specify performance requirements and schedule doors and hardware. Re-use of recovered hardware can be scheduled in *0201 Demolition* or *0202 Demolition (interior and alterations)* and the standard of refurbishment work to recovered hardware is covered in the **SUBMISSIONS** clause in *0455 Door hardware*.

· Sanitary facilities:

Accessible facilities, including ambulant and unisex accessible compartments, need to be provided for new work. Ambulant compartments may be provided by upgrading existing cubicles (provided they are adequately sized) with grab rails, appropriately positioned toilet paper dispensers, and correct height and type of toilet seats and backrests. *0802 Hydraulic design and install, 0811 Sanitary fixtures* and *0812 Tapware* may be used to specify fixtures and fittings conforming to AS 1428.1 and AS 1428.2 for accessible sanitary facilities and showers. Grab rails, toilet backrests and shower seats may be covered in *0191 Sundry items*.



The Perpetual Building, Sydney. Jackson Teece Architects, 2010. Refurbishment of heritage listed office building to create contemporary offices with a 6 Star Green Star Office Design rating.





Unilever House, London, Kohn Pedersen Fox, 2008 Extensive reconfiguration and refurbishment of the interior, and conservation and restoration to the façade of the Grade II listed 1930s office building. Additions include offices, conference area, exhibition space, restaurant, cafe and roof garden.

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• Stairs, ramps and walkways:

Stairs, ramps and walkways in the required path of travel may only need minor modifications if existing risers, goings, gradients and handrail provisions comply. Handrails to AS 1428.1 and AS 1428.2 may be specified in 0552 Metalwork – fabricated. Luminance contrast for stair tread nosings and tactile ground surface indicators (TGSIs) to AS/NZS 1428.4.1 and AS 1428.2 may be specified in the pavements series 0272 Asphalt to 0279 Paving - on pedestals, timber worksection 0383 Decking, sheet and panel flooring, fixtures worksections including 0551 Joinery and 0552 Metalwork - fabricated, trowelled and sprayed coatings worksection 0613 Terrazzo in situ, tiling worksections including 0631 Ceramic tiling, 0632 Stone and terrazzo tiling and in the floor surfacing series 0651 Resilient finishes to 0657 Resin based seamless flooring.

Stairlifts are an option for low rise buildings where there are no lifts and it is not practical to install ramps. Where there is sufficient space, a platform lift may be used to supplement stairs not more than 1 m high in an entrance and lobby. Reversible interventions such as threshold ramps and landings may be a practical solution for overcoming access issues in heritage buildings, where altering the existing built fabric is not permitted.⁵

• Lift and lift lobby refurbishment:

Existing lifts in the accessible path of travel may only require a minor refurbishment to comply if the internal dimensions meet NCC requirements. Upgrades may include providing handrails, and braille and tactile buttons to AS 1735.12 in both the lift car and at landings. Lifts serving more than 2 levels also require audible and visual information identifying stops and the position of the car.

• Floor finishes:

Firm, stable, slip-resistant flooring is required for an accessible path of travel. Existing uneven floors may need self-levelling, cementitious toppings applied to create a suitable substrate for new finishes. However, consideration should be given to the effect such changes in floor levels may have on stairs, where riser heights and floor gradients may be affected.

Tactile ground surface indicators (TGSIs) to AS/NZS 1428.4.1 and AS 1428.2 are required.

Highly polished or glossy surfaces on an accessible path of travel may cause glare and become slip hazards and should be avoided. *0612 Cementitious toppings*, *0613 Terrazzo in situ*, *0631 Ceramic tiling*, *0632 Stone and terrazzo tiling*, *0651 Resilient finishes* and *0657 Resin based seamless flooring* have provisions for specifying the level of slip resistance required. Low pile carpets may be specified in *0652 Carpets*. Sustainable refurbishment options such as re-use of recovered carpet tiles can be scheduled in *0201 Demolition*. *0652 Carpets* covers re-usable carpet tile backing in the **CARPET TILES** clause.

0224 Stormwater – site may be used to specify grates and covers located on the path of travel to AS 1428.1 and AS 1428.2.

• Signage:

Areas that require braille and tactile signage include new accessible sanitary facilities, rooms with hearing augmentation systems, non-accessible pedestrian entrances and egress doors that require illuminated signs. *0581 Signage* may be used to specify signage to AS 1428.1 and AS 1428.2, and other statutory signage.

• Carparking:

Carparking may only need modifications to linemarking if existing building geometry allows for accessible carparking spaces in accordance with AS/NZS 2890.6. *0581 Signage* may be used to specify linemarking for accessible carparking facilities.

3.6 Mechanical services

A minor upgrade to the mechanical systems may include installing metering, recommissioning systems to operate at their maximum efficiency, and upgrading and tuning existing controls and the Building Management System (BMS) to ensure the system only functions when the spaces are occupied. 0773 Building management systems, 0791 Mechanical commissioning and 0792 Mechanical maintenance, may be adapted as required to suit an existing installation. Work on existing systems can be specified in 0701 Mechanical systems.



Q Station, Manly Paul Davies Architects, Cate Young Design, 2010 Conservation and adaptive reuse of the North Head Quarantine Station. Precinct includes a hotel, function rooms, restaurant, bar, visitor centre and museum.



Queensland Museum, South Brisbane Cox Rayner, 2012 Upgrade of the 1980s building to improve the internal circulation, public facilities, lighting and staff areas. New café and new entry created off Grey Street.

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A major upgrade may include cleaning and rebalancing ductwork and pipe work systems, upgrading filters on air handling units (AHUs), and installing variable speed drives on fans and pumps to improve energy efficiency. Other options include replacing old and inefficient equipment, selecting more efficient pumps and fans or converting existing variable air volume (VAV) systems to low temperature VAV systems.⁶ 0714 Mechanical pumps and 0731 Fans may be used for specifying upgrades to these component

A total refurbishment is an opportunity to lower building energy consumption and improve indoor environment quality by replacing the existing air conditioning system with a new low energy system, such as a mixed mode system or chilled beams. Mixed mode VAV system air conditioning can be specified in 0701 Mechanical systems, 0715 Chillers – combined, 0714 Mechanical pumps and 0724 Air handling plant – combined. Mechanical subgroups 073 Air handling components and 074 Ductwork and components, particularly 0747 Variable air volume terminals, will also be relevant. 0773 Building management systems can be used to specify automated operation of windows and blinds for a mixed mode system.

3.7 On-site power generation

• Cogeneration and trigeneration:

These systems produce electricity and thermal energy from a single fuel source (commonly natural gas). 0931 Power generation – engine driven may be used to specify either a cogeneration system, which supplies electricity and heat for space heating, hot water and steam,⁷ or a trigeneration system which goes a step further and provides cooling. Another option to consider, if available, is connection to a local trigeneration energy network.

· Solar power:

Renewable solar energy may supplement a portion of a building's electricity or hot water needs. *0802 Hydraulic design and install* can be used to specify solar hot water systems. *0933 Power generation – photovoltaic* may be used to document stand-alone or grid connected solar photovoltaic (PV) systems.

3.8 Water conservation

· Fixtures and equipment:

There is considerable potential for conserving water by specifying water efficient fixtures and equipment. *0811 Sanitary fixtures* may be used to schedule water efficient toilets and low water use/waterless urinals. Water efficient tapware and showerheads to AS/NZS 6400 can be scheduled in *0812 Tapware*. *0191 Sundry items* may be used to document selected equipment such as water efficient dishwashers and washing machines.

• Landscape irrigation:

Water consumption may be reduced for irrigation in refurbishment projects through using recycled water or installing low water using xeriscape gardens. *0825 Rainwater storage systems* has provisions for specifying rainwater tanks and ancillaries.

• Heat rejection water systems (cooling towers):

Water consumption may be decreased by specifying low water use cooling towers, reducing water use by increasing cycles of concentration and non-water consuming alternatives to cooling towers. *0713 Cooling towers* has provisions for specifying these water conserving options.

· Fire safety systems:

Thousands of litres of water a year may be wasted during fire protection system tests.⁸ *1033 Sprinklers* may be used to specify systems that recirculate water during the test or capture and re-use it on site. Water may also be conserved by improving fire sprinkler zoning to allow floor-by-floor testing.

• Water harvesting and re-use:

Where permitted by authorities, rainwater and greywater harvesting and re-use may significantly reduce potable water consumption. NATSPEC includes *0825 Rainwater storage systems* and *0826 Greywater systems* for specifying these systems.



Sydney Town Hall, Tanner Architects, 2008 Staged refurbishment of heritage listed 1880s building including services upgrade.



The Hespeler Library, Cambridge, Canada Kongats Architects, 2006. Preservation of the historic 1922 building and expansion of the library facilities through contemporary glass encasement.

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3.9 Fire safety

Upgrading fire safety systems to conform to current requirements may include installing, modifying or replacing emergency warning systems, smoke detection and control systems, and sprinklers.⁹ Other issues include providing passive fire protection to the existing structure, and fire stair remodelling and pressurisation.¹⁰

Electrical fire system upgrades or replacements can be specified in 1072 Fire detection and alarms, and 1073 Emergency warning and intercommunication. Hydraulic upgrades may be covered in 1031 Hydrants, 1032 Hose reels and 1033 Sprinklers.

Upgrades to the existing structure to meet current regulations or due to change of use may be covered in 0346 Structural fire protection systems. Individual worksections such as 0331 Brick and block construction and 0321 Precast concrete have provisions to specify fire rating requirements. Fire protection of service penetrations and control joints may be covered in 0182 Fire-stopping. Other fire-stopping measures such as fire doors and smoke seals may be specified in 0453 Doors and access panels.

3.10 Lighting

Replacing outdated lighting may assist in reducing energy consumption, improving the indoor environment quality and reducing internal heat load. Options include installing energy efficient T5 fluorescent lamps and replacing incandescent lamps (including tungsten halogen and tungsten filament) with compact fluorescent or LEDs. Other options include providing automatic lighting controls, daylight sensors, motion detector sensors, and wiring of lighting to allow for separate switching of day-lit perimeter zones. Designing low level background illumination and supplementing with task lighting may also help reduce energy consumption. Upgrading external lighting may also help reduce light pollution through controlling light spill and upwards wasted light at night.

Provisions for specifying these upgrade options as well as refurbishment and re-use of existing luminaires can be scheduled in SELECTIONS in *0951 Lighting*.

4 USING NATSPEC

As a specification template, NATSPEC will not contain all the technical requirements for every project. Specifying refurbishment, retrofit and adaptive re-use projects is similar to a new build project - the specifier will need to select the appropriate NATSPEC worksections and edit the material to suit the project. Editing may include deletion of options, or samples and tests clauses when not required. It may also include revising the quality level, adding new material that is not covered by the NATSPEC templates and editing standard text where it conflicts with project requirements, drawings, and completed prompts, or with added new material. For a step-by-step procedure for producing a specification from the NATSPEC templates, refer to the NATSPEC paper *Specification Writing*.



500 Collins Street, Melbourne Peddle Thorp Architects. Staged refurbishment of a1970s office building. 5 Star Green Star - Office Design v1 Certified Rating awarded in October 2006.



86-88 George Street, Sydney *Terroir Architects 2007.* Refurbishment of the heritage building's commercial office and retail spaces. State heritage listed building with a 5 star Green Star office design rating.

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REFERENCED STANDARDS

AS 1428 AS 1428.1:2021	Design for access and mobility General requirements for access – New building work
AS 1428.2:1992	Ennanced and additional requirements – Buildings and facilities
AS/NZS 1428.4.1:2009	ground surface indicators
AS 1735	Lifts, escalators and moving walks
AS 1735.12:1999	Facilities for persons with disabilities.
AS 1735.12:2020	Facilities for persons with disabilities (EN 81-70:2018, MOD)
AS 2890	Parking facilities
AS/NZS 2890.6:2009	Off-street parking for people with disabilities.
AS 2890.6:2022	Off-street parking for people with disabilities
AS/NZS 6400:2016	Water efficient products - Rating and labelling

¹Australian Government Department of Climate Change the Environment and Energy, 2007, Energy Efficiency in government operations (EEGO) Fact Sheet 9 of 12. www.environment.gov.au/system/files/energy/files/buildingrefurbishmentfs.pdf

² 1200 buildings *What is a building retrofit* ? City of Melbourne.

³ Australian Government Department of Environment and Heritage, 2004, Adaptive Re-use - Preserving our past, building our future.

www.environment.gov.au/heritage/publications/adaptive-reuse

⁴ Robinson, J, 2010, Refurbishment of Existing Buildings: Good for the Planet and the Bottom Line.

http://higherlogicdownload.s3.amazonaws.com

⁵ Department of Environment, Land, Water and Planning, Access for all to Heritage Places, 2008, Victoria State Government. https://www.heritage.vic.gov.au/__data/assets/word_doc/0022/505255/Disability-access-forheritage-places.docx

⁵ Eric Martin and Associates Architects, Access to Heritage Place Guidelines, Vic, January 2018.

http://www.emaa.com.au/uploads/4/6/3/2/46326229/20180112 access to heritage _buildings_guidelines_vic.pdf

⁶ Robinson, J, 2010, Refurbishment of Existing Buildings: Good for the Planet and the Bottom Line, p14.

⁷ NSW Office of Environment and Heritage 2014, Energy Saver Cogeneration feasibility guide

https://www.environment.nsw.gov.au/resources/business/140685-cogeneration-feasibilityguide.pdf

⁸ Plumbing Industry Commission 2009, *Guide to Fire Sprinkler System Water Saving*. https://www.yumpu.com/en/document/read/31859079/fact-sheet-plumbing-industrycommission

⁹ Adelaide City Council and Jones Lang LaSalle, 2007, *Building Refurbishment Guide*. https://silo.tips/download/building-refurbishment-guide

¹⁰ OneSteel, 2000, *Fire engineering aids AMP's refurbishment*. https://www.libertygfg.com/media/54853/fire-engineering-aids-amps-refurbishment.pdf





High Line, New York James Corner Field Operations, Diller Scofidio + Renfro, Piet Oudolf, 2009-2014.

Staged adaptive re-use of a disused 1930s elevated freight train line to a public park.

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APPENDIX A: NATSPEC REFURBISHMENT WORKSECTIONS

027

0272 Asphalt

01 G	ENERAL
013	Generic preliminaries
0133	Preliminaries (Interior and
0.00	alterations)
014	Contract preliminaries
0140	Preliminaries - ABIC 2018 C
0140	Proliminarios ABIC MW 2018
0141	Preliminaries - ABIC SW-2018
0142	Proliminarios AS 2124
0143	Proliminarios AS 4000
0144	Proliminarios AS 4000
0145	Proliminarios AS 4903
0140	Preliminaries - AS 4902
0149	Conoral requirements
0171	General requirements
0171	General requirements
0172	
0101	Adheeiyee ecclente and
0101	footoporo
0400	
0182	Fire-stopping
0183	Metals and prelinisnes
0184	Termite management
0185	Timber products, finishes and
040	
019	Sundry Installations
0191	Sundry liems
0193	
02 5	TIE, URBAN AND OPEN
SPA	CES
020	Demolition
020 0201	Demolition Demolition
020 0201 0202	Demolition Demolition Demolition (interior and
020 0201 0202	Demolition Demolition Demolition (interior and alterations)
020 0201 0202 022	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork
020 0201 0202 022 0221	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation
020 0201 0202 022 0221 0222	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork
020 0201 0202 022 0221 0222 0223	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching
020 0201 0202 0221 0222 0223 0223 0224	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site
020 0201 0202 0221 0222 0223 0223 0224 0225	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores
020 0201 0202 0221 0222 0223 0224 0225 024	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures
020 0201 0202 0221 0222 0223 0224 0225 024 0241	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0241 0242	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - fences and barriers
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0242 0243 0243	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - fences and barriers Landscape - water features
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0242 0243 0243 025 0250	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - fences and barriers Landscape - water features Landscape cultivation
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0242 0243 025 0250 0250	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - fences and barriers Landscape - water features Landscape - water features Landscape - combined
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0242 0243 025 0250 0251 0250	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - fences and barriers Landscape - fences and barriers Landscape - water features Landscape - water features Landscape - combined Landscape - soils
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0242 0243 025 0250 0251 0252	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - fences and barriers Landscape - water features Landscape - water features Landscape - combined Landscape - soils Landscape - natural grass
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0242 0243 0250 0251 0252	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - fences and barriers Landscape - water features Landscape - water features Landscape - water features Landscape - combined Landscape - soils Landscape - natural grass surfaces
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0242 0243 0250 0251 0252 0253 0254	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - walling and edging Landscape - water features Landscape - water features Landscape - combined Landscape - combined Landscape - soils Landscape - natural grass surfaces Landscape - planting
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0242 0243 0250 0251 0252 0253 0254 0254 0254	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - walling and edging Landscape - walling and edging Landscape - water features Landscape - water features Landscape - combined Landscape - combined Landscape - soils Landscape - natural grass surfaces Landscape - planting Irrigation
020 0201 0202 0222 0223 0224 0225 024 0241 0242 0243 0241 0242 0243 0250 0251 0252 0253 0254 0255 0256	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - fences and barriers Landscape - fences and barriers Landscape - water features Landscape - water features Landscape - combined Landscape - soils Landscape - soils Landscape - natural grass surfaces Landscape - planting Irrigation Landscape - plant procurement
020 0201 0202 0221 0222 0223 0224 0241 0242 0243 0241 0242 0243 0250 0251 0252 0255 0255 0255 0256 0255	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - fences and barriers Landscape - fences and barriers Landscape - water features Landscape - water features Landscape - ombined Landscape - combined Landscape - soils Landscape - natural grass surfaces Landscape - planting Irrigation Landscape - establishment Landscape - establishment
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0242 0243 0250 0251 0252 0253 0254 0255 0256 0256 0259 025	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - fences and barriers Landscape - fences and barriers Landscape - water features Landscape - water features Landscape - ombined Landscape - combined Landscape - soils Landscape - natural grass surfaces Landscape - planting Irrigation Landscape - plant procurement Landscape - establishment Landscape - maintenance
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0242 0243 025 0251 0252 0251 0252 0255 0256 0256 0256 0259 0264	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - fences and barriers Landscape - fences and barriers Landscape - water features Landscape - water features Landscape - ombined Landscape - combined Landscape - soils Landscape - natural grass surfaces Landscape - planting Irrigation Landscape - plant procurement Landscape - establishment Landscape - maintenance Landscape - maintenance
020 0201 0202 0221 0222 0223 0224 0242 0243 0242 0243 0255 0250 0251 0252 0255 0256 0255 0256 0259 026 0261	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - water features Landscape - lences and barriers Landscape - water features Landscape - ormbined Landscape - combined Landscape - soils Landscape - soils Landscape - planting Irrigation Landscape - plant procurement Landscape - plant procurement Landscape - maintenance Landscape - maintenance Landscape - furniture and fixtures
020 0201 0202 0221 0222 0223 0224 0225 024 0241 0242 0243 0250 0251 0252 0250 0251 0252 0255 0256 0259 026 0261	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - water features Landscape - fences and barriers Landscape - water features Landscape - outlivation Landscape - combined Landscape - soils Landscape - natural grass surfaces Landscape - planting Irrigation Landscape - planting Irrigation Landscape - establishment Landscape - maintenance Landscape - furniture and fixtures
020 0201 0202 0221 0222 0223 0224 0242 0243 025 0250 0251 0252 0255 0256 0255 0256 0259 026 0261 0262	Demolition Demolition Demolition (interior and alterations) Preparation and groundwork Site preparation Earthwork Service trenching Stormwater – site Water bores Landscape structures Landscape - walling and edging Landscape - fences and barriers Landscape - lences and barriers Landscape - water features Landscape - vater features Landscape - combined Landscape - soils Landscape - natural grass surfaces Landscape - planting Irrigation Landscape - plant procurement Landscape - establishment Landscape - maintenance Landscape - maintenance Landscape - furniture and fixtures External sports and playground surfacing

0274 Concrete pavement 0275 Paving - mortar and adhesive bed 0276 Paving - sand bed 0277 Pavement ancillaries 0278 Granular surfaces 0279 Paving - on pedestals 03 STRUCTURE 030 Foundations 0301 Piling 031 Concrete - In situ 0310 Concrete - combined 0311 Concrete formwork 0312 Concrete reinforcement 0313 Concrete post-tensioned 0314 Concrete in situ 0315 Concrete finishes 0318 Shotcrete 032 Concrete - Systems 0321 Precast concrete 0322 Tilt-up concrete 033 Masonry 0331 Brick and block construction 0332 Stone masonry 0333 Stone repair 0334 Block construction 0335 Brick construction

Pavements

0271 Pavement base and subbase

0273 Sprayed bituminous surfacing

034 Steel

- 0341 Structural steelwork
- 0342 Light steel framing
- 0343 Tensioned membrane structures 0344 Steel - hot-dip galvanized
- coatings
- 0345 Steel protective paint coatings
- 0346 Structural fire protection systems
- 036 Earth
- 0361 Monolithic stabilised rammed earth walls
- 0362 Mud brick and pressed earth block walls
- 0363 Straw bale walls

038 Timber

- 0381 Structural timber
- 0382 Light timber framing
- 0383 Decking, sheet and panel flooring

0385 Cross-laminated timber (CLT)

04 ENCLOSURE

- Tanking and damp-proofing 041 0411 Waterproofing - external and
- . tanking

042 Roofing

- 0420 Roofing combined 0423 Roofing - profiled sheet metal
- 0424 Roofing seamed sheet metal
- 0425 Roofing shingles and shakes
- 0426 Roofing slate
- 0427 Roofing tiles

- 0428 Roofing insulated panel
- systems

0429 Roofing - glazed

- 043 Cladding
- 0430 Cladding combined 0432 Curtain walls
- 0433 Stone cladding
- 0434 Cladding flat sheets and panels 0435 Cladding - planks and weatherboards
- 0436 Cladding profiled and seamed sheet metal
- 0437 Cladding - insulated panel systems

045 **Doors and windows**

- 0451 Windows and glazed doors
- 0453 Doors and access panels
- 0454 Overhead doors
- 0455 Door hardware
- 0456 Louvre windows
- 0457 External screens
- 046 Glass
- 0461 Glazing
- 0462 Structural silicone glazing
- 0463 Glass blockwork
- 0466 Structural glass assemblies
- 0467 Glass components
- 047 Insulation
- 0471 Thermal insulation and pliable membranes

0472 Acoustic insulation

05 INTERIOR 051 Linings

- 0511 Lining
- 052 Partitions 0520 Partitions - combined
- 0521 Partitions demountable
- 0522 Partitions framed and lined
- 0523 Partitions brick and block
- 0524 Partitions glazed
- 0525 Cubicle systems
- 0526 Terrazzo precast
- 0527 Room dividers
- 053 Ceilings
- 0530 Suspended ceilings combined
- 0532 Suspended ceilings flush lined
- 0533 Suspended ceilings ceiling units
- 054 Access floors
- 0541 Access floors
- 055 Fixtures
- 0551 Joinery
- 0552 Metalwork fabricated
- 0553 Stainless steel benching
- 057 Furniture and furnishings
- 0571 Workstations
- 0572 Miscellaneous furniture
- 0573 Fire extinguishers and blankets 0574 Window coverings
- 0575 Tapestries
- 058 Signs and features
- 0581 Signage

APPENDIX A: NATSPEC REFURBISHMENT WORKSECTIONS

0741 Ductwork

06 FI	INISH
061	Trowelled and spraved
	coatings
0611	Rendering and plastering
0612	Cementitious toppings
0613	Terrazzo in situ
062	Wet areas
0621	Waterproofing - wet areas
063	Tiling
0631	Ceramic tiling
0632	Stone and terrazzo tiling
064	Wall surfacing
0641	Applied wall finishes
0642	Wallcoverings
065	Floor surfacing
0651	Resilient finishes
0652	Carpets
0654	Multilavered board flooring
0655	Timber flooring
0656	Floor sanding and finishing
0657	Resin based seamless flooring
067	Painting
0671	Painting
0672	Textured and membrane
	coatings
0673	Powder coatings
07 M	FCHANICAL
070	Mechanical general
	moonanoa gonora
0701	Mechanical systems
0701 0702	Mechanical systems Mechanical design and install
0701 0702 071	Mechanical systems Mechanical design and install Water plant
0701 0702 071 0710	Mechanical systems Mechanical design and install Water plant Mechanical services tanks.
0701 0702 071 0710	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers
0701 0702 071 0710	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water beaters – air source
0701 0702 071 0710 0711 0712	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired
0701 0702 071 0710 0711 0712 0713	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers
0701 0702 071 0710 0711 0712 0713 0714	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps
0701 0702 071 0710 0711 0712 0713 0714 0715	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined
0701 0702 071 0710 0711 0712 0713 0714 0715 0716	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - centrifugal
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - contrifugal Chillers - water cooled screw
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - water cooled screw Chillers - air cooled screw and
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - conded screw Chillers - air cooled screw and scroll
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - water cooled screw Chillers - air cooled screw and scroll Chillers - absorption
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 072	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - contrifugal Chillers - air cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 072 0721	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - contrifugal Chillers - water cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant Packaged air conditioning
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 0721 0722	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - centrifugal Chillers - water cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant Packaged air conditioning Room air conditioners
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 072 0721 0722 0723	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - centrifugal Chillers - water cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant Packaged air conditioning Room air conditioners Evaporative air coolers
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 0721 0721 0721 0723 0723	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - contrifugal Chillers - air cooled screw Chillers - air cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant Packaged air conditioning Room air conditioners Evaporative air coolers Air handling plant - combined
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 072 0721 0722 0723 0724 0725	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - contrifugal Chillers - air cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant Packaged air conditioning Room air conditioners Evaporative air coolers Air handling plant - combined Air bandling plant - built up
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 072 0721 0722 0723 0724 0725 0726	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - contrifugal Chillers - air cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant Packaged air conditioning Room air conditioners Evaporative air coolers Air handling plant - combined Air handling plant - built up
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 072 0721 0722 0723 0724 0725 0726 0727	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - centrifugal Chillers - water cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant Packaged air conditioning Room air conditioners Evaporative air coolers Air handling plant - built up Air handling plant - minor Air handling plant - packaged
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 072 0721 0722 0723 0724 0725 0726 0727 073	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - air cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant Packaged air conditioning Room air conditioners Evaporative air coolers Air handling plant - combined Air handling plant - minor Air handling plant - packaged
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 072 0721 0722 0723 0724 0725 0726 0726 0727 0731	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - contrifugal Chillers - air cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant Packaged air conditioning Room air conditioners Evaporative air coolers Air handling plant - combined Air handling plant - minor Air handling plant - packaged Air handling components Fans
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 072 0721 0722 0723 0724 0725 0726 0726 0727 073 0731	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - contrifugal Chillers - air cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant Packaged air conditioning Room air conditioners Evaporative air coolers Air handling plant - combined Air handling plant - built up Air handling plant - packaged Air handling components Fans Air filters
0701 0702 071 0710 0711 0712 0713 0714 0715 0716 0717 0718 0719 072 0721 0722 0723 0724 0725 0726 0727 073 0731 0732 0733	Mechanical systems Mechanical design and install Water plant Mechanical services tanks, vessels and heat exchangers Water heaters – air source Water heaters – gas-fired Cooling towers Mechanical pumps Chillers - combined Chillers - combined Chillers - centrifugal Chillers - air cooled screw Chillers - air cooled screw and scroll Chillers - absorption Air plant Packaged air conditioning Room air conditioners Evaporative air coolers Air handling plant - combined Air handling plant - built up Air handling plant - packaged Air handling components Fans Air filters Air coils

0736	Space heating

0744 Ductwork insulation 0745 Attenuators and acoustic louvres 0746 Air grilles 0747 Variable air volume terminals 0748 Chilled beams 075 Piping 0751 Mechanical piping 0752 Mechanical piping insulation 0753 Water treatment 0754 Liquid fuels 0755 Medical gas systems 076 Refrigeration 0761 Refrigeration 0762 Cool rooms 077 Control 0771 Automatic controls 0772 Automatic controls - minor 0773 Building management systems Mechanical electrical 078 0781 Mechanical electrical 0782 Mechanical electrical - minor 0784 Motors and starters Mechanical commissioning 079 and maintenance 0791 Mechanical commissioning 0792 Mechanical maintenance **08 HYDRAULIC** Hydraulic general 080 0801 Hydraulic systems 0802 Hydraulic design and install 081 Hydraulic components 0811 Sanitary fixtures 0812 Tapware 0813 Water heaters 0814 Hydraulic pumps 0815 Drinking water dispensers 0816 Hydraulic services tanks 082 Hydraulic systems 0821 Stormwater - buildings 0822 Wastewater 0823 Cold and heated water 0824 Fuel gas 0825 Rainwater storage systems 0826 Greywater systems Hydraulic electrical 088 0882 Hydraulic electrical - minor Hydraulic commissioning and 089 maintenance 0891 Hydraulic maintenance

074 Ductwork and components

09 ELECTRICAL

- Electrical general 090
- 0901 Electrical systems
- 0902 Electrical design and install
- 091 Electrical equipment
- 0911 Cable support and duct systems

- 092 **Power systems**
- 0921 Low voltage power systems
- 0925 Electric vehicle charging systems
- 093 Power supply equipment
- 0931 Power generation engine driven
- 0933 Power generation photovoltaic
- 0937 Uninterruptible power supply
- 094 **Power distribution equipment**
- 0941 Switchboards proprietary 0942 Switchboards - custom-built
- 0943 Switchboard components 0947 Power factor correction
- 095 Lighting systems
- 0951 Lighting
- Communication systems 096
- 0961 Information and communications technology (ICT) systems
- 0962 Television distribution systems
- 0963 Sound systems
- 097 Safety systems
- 0971 Emergency evacuation lighting
- 0979 Lightning protection
- Security systems 098
- 0981 Electronic security
- Electrical commissioning and 099 maintenance
- 0991 Electrical maintenance

10 FIRE

- Fire general 100
- 1001 Fire services systems
- 1002 Fire services design and install
- 101 Fire components 1014 Fire services pumps
- 1016 Fire services tanks
- 103 Wet fire suppression systems
- 1030 Combined wet fire suppression systems
- 1031 Hydrants
- 1032 Hose reels
- 1033 Sprinklers
- 104 Dry fire suppression systems
- 1041 Gaseous fire suppression systems
- 105 **Chemical fire suppression** systems
- 1051 Liquid chemical fire suppression systems
- **107 Fire safety systems** 1072 Fire detection and alarms
- 1073 Emergency warning and intercommunication
- 108 **Fire electrical**
- 1082 Fire services electrical minor
- Fire commissioning and 109 maintenance
- 1091 Fire services maintenance
- 20 CONVEYING
- 201 **Conveying equipment**
- 2011 Lifts design and install

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