2019 Collegiate Turf Bowl Competition Study Guide

GCSAA would like to thank Leah Brilman, Ph.D., a member of the Turfgrass Breeders Association, and Gwen Stahnke, Ph.D., facilitators of the Turf Bowl, for their work updating and modifying the exam each year.

The Turf Bowl Competition consists of physical and visual identification of samples, multiple choice, fill-in-the-blank, essay, short answer and matching questions.

A list of resources to study for this portion of the exam is included in this document. We also recommend reaching out to local superintendents, chapters or alumni for their help in preparing for the case study/essay section.

If you have any questions about the competition, contact Diana Kern at dkern@gcsaa.org or (785) 832-3600.

Eligibility

To participate in the GCSAA Collegiate Turf Bowl Competition, students must meet all of the following eligibility criteria:

- Must be currently enrolled in an undergraduate turf program or have graduated at the end of the most recent fall semester but not yet entered a graduate program or begun full-time employment at a golf facility
- Meet GCSAA student member eligibility criteria
- Be a registered attendee at the GCSAA Education Conference and Golf Industry Show

Area of Study

Turfgrass Identification

- Identify live turf specimens and seed specimens by their common names.
- Know common name vs. scientific name.
- For specific turfgrass species, please see Addendum 1.

Turfgrass Growth and Development

- Identify parts of the grass plant.
- Know management and environmental factors that influence growth.
- Understand turfgrass physiology and how it is influenced by management practices.
- Understand plant growth regulators – Use and influence on biology

Turfgrass Soils and Soil Fertility

- Know greens construction, particle sizes, soils and fertility.
- Know of macronutrients and micronutrients, and their influence on growth.
- Soil types and classification

Weed Identification and Control

- Identify common weeds. Note: Any turfgrasses on list can also be weeds.
- Know herbicides, what weeds they control and mode of action.
- Know the life cycle of weeds and how management influences weed growth.
- Know seed labeling for crops and weeds.
- For specific weeds, please see Addendum 2.

Turfgrass Diseases

- Identify common diseases on turf stands.
- Know environmental and management conditions, and the types of diseases that the conditions favor.
- Know common fungicides.
- Know grass species corresponding to various diseases.
- For specific diseases, please see Addendum 3.

Turfgrass Mathematics

- Calculate application rates of chemicals and fertilizers.
- Know quantities of sand and seed to use.
- Know how to correctly calibrate application equipment.
- Know how to use both the Metric and English units in calculations.

Turfgrass Insects

- Identify specimens of larval and adult forms of insects that attack turf.
- Know life cycles, preferred foods, feeding methods and other characteristics important in controlling insects.
- For specific insects, please see Addendum 4.

Irrigation

- Know how to evaluate turfgrass water needs and adjust various irrigation methods and rates accordingly to ensure the efficiency and effectiveness of the irrigation system.
- Calculate water usage.
- Know how to read an irrigation nozzle flow chart.
- Know the basics of using reclaimed water for irrigation.

Water Management

- Understand how turfgrasses process water, including transpiration.
- Understand water terminology
- Know the symptoms of water stress in various turfgrasses and how to remedy.
- Know the causes of pesticide and nutrient runoff and how to prevent.

Business Management

- Employment laws
- Budget, accounting and financial management principles
- Equipment leases
- Depreciation
- Staff management
- Employee training
- Employee performance management
- Amortization

Case Study

- The essay will be graded based on a team's ability to:
    - Follow instructions given in the scenario.
    - Provide clear and concise answers.
    - Demonstrate critical thinking.
    - Use proper spelling and grammar.
- Students will have 30 minutes to write their answer to one of the following scenarios. Only one of the scenarios will be selected to address.
- Again, students are **strongly encouraged** to seek out local superintendents, chapters or alumni to help them research their answers to these real-world scenarios. Valuable information may also be found in member sections of gcsaa.org and on eifg.org.

Wakanda Golf and Country Club

Wakanda Golf and Country Club is a private 18-hole course in San Jose, California. The course, built in 1954, is situated on 135 acres, with 30 acres of fairway and 51 acres of rough. Over the last 14 years, it has been the host to LPGA and Nike Tour events. The greens are bentgrass, and the tees and fairways are perennial ryegrass. Greens fees are $108.00.

Anthony Challa, CGCS, has been the superintendent at Wakanda Golf and Country Club for the past seven years. In addition to Anthony, there is a maintenance team of eleven

full time employees and eight seasonal employees, including one assistant, one equipment manager and one equipment technician.

Approved Budget for 2019:

Operating		***Capital***	
Payroll	$700,000	Golf Course	$ 230,000
Fertilizer/Chemicals	140,000	Buildings/Grounds	225,000
Water	260,000	Equipment	235,000
Seed	28,000	**Total:**	$690,000
Equipment Maintenance/Leasing	65,000		
Supplies	47,500		
Fuel	36,000		
Professional Development	8,500		
Total:	$1,285,000		

Scenario 1: The state of California has imposed mandatory water restrictions. Your county requires a 25% reduction in overall irrigation use for the current year. Develop a water conservation plan which includes three practices you will implement to come under compliance. In addition, account for probable continued reductions.

Scenario 2: The golf course was used as a staging area for emergency equipment responding to the wildfires. The fairways, greens and tee boxes for holes 1, 9, 10 and 18 have damage, which includes collapsed drain tile, rutting and dead turf from heavy traffic. Formulate a plan to remediate the current damage. Provide justification for the procedures in your plan. Create a future emergency response plan designed to minimize damage to the course.

Scenario 3: The course has a 25-year-old irrigation system that utilizes a block design with hydraulic controllers. Irrigation labor hours has increased 6% over the last three years and now account for 10% of total labor. Parts costs are now 25% of the supplies budget, a 50% increase in just five years. Develop an outline for a presentation to your Green Committee, highlighting the need to replace the old system. Identify three selling points for a new system.

Scenario 4: The course usually does fall aeration in mid-August. Some of the membership are complaining that the course isn't ready for play for the Labor Day weekend; however, others prefer this timing to ensure the course is in great shape for member championship tournament held in late September. For the upcoming club's newsletter, write an article explaining aerification. Be sure to address the timing and benefits of the maintenance practice.

Equipment Identification Section

Teams will be asked to identify parts of the irrigation head and valves. Schematics for this piece of equipment are included in Addendum 5, at back of the study guide.

Resources

The following resources, along with GCSAA's monthly publication *Golf Course Management* magazine, are recommended as study resources. The textbooks may be available through your school library, local bookstore or through the **GCSAA Store online at** www.cswebstore.net/gcsaa/ **.**

1. **The Mathematics of Turfgrass Maintenance** (*Third Edition*) – Michael Agnew and Nick Christians
2. **Mathematics for the Green Industry: Essential Calculations for Horticulture and Landscaping Professionals -** Michael Agnew, Nancy Agnew, Ann Marie VanDerZanden and Nick Christians
3. **Turfgrass Management** (*Fifth or Sixth Edition*) – A.J. Turgeon
4. **Fundamentals of Turfgrass Management** – Nick Christians
5. **Turf Management for Golf Courses** (*2 nd Edition*) – James B. Beard
6. **Salt-Affected Turfgrass Sites: Assessment and Management** – R.N. Carrow and R.R. Duncan
7. **Managing Turfgrass Pests –** Thomas L. Watschke, Peter H. Dernoden and David J. Shetlar
8. **Controlling Turfgrass Pests** (*2 nd Edition*) – Thomas W. Fermanian, Malcom C. Shurtleff, Roscoe Randell, Henry T. Wilkinson and Philip L. Nixon
9. **Creeping Bentgrass Management: Summer Stresses, Weeds and Selected Maladies** – Peter H. Dernoden
10. **Human Resource Management for Golf Course Superintendents, ch. 6** – Bob Milligan and Tom Maloney
11. **Superintendents Handbook of Financial Management, ch. 2, 3, 5, and 9** – Ray Schmidgall
12. **The Turf Problem Solver: Case Studies and Solutions for Environmental, Cultural and Pest Problems** – A.J. Turgeon and J.M. Jr. Vargas (Dec. 2, 2005)
13. **Identifying Turf and Weedy Grasses of the Northern United States** – D. Pedersen and T. Voight Illinois Pocket ID series University of Illinois Extension pubsplus.uiuc.edu

14. **Turfgrass Identification Tool – Purdue University Turfgrass Science Department of Agronomy** (vernation) - agry.purdue.edu/turf/tool/index.html
15. **Turfgrass Identification** (vernation)- David Gardner, The Ohio State University buckeyeturf.osu.edu/pdf/01_turfgrass_identification.pdf
16. Best Management Practices for Turfgrass Water Conservation commodities.caes.uga.edu/turfgrass/georgiaturf/Publicat/1650_BMP_H2O.htm
17. Best Management Practices: Where Leadership & Action Intersect – GCSAA https://www.gcsaa.org/environment/bmp-planning-guide
18. Golf Course Environmental Profile eifg.org/research/golf-course-environmental-profile

Addendum 1

Cool Season Grasses

Common name	Scientific name
1. Kentucky bluegrass	*Poa pratensis*
2. Perennial ryegrass	*Lolium perenne*
3. Tall fescue	*Festuca arundinacea = Schedonorus arundinaceus = Lolium arundinaceum*
4. Hard fescue	*Festuca brevipila (F. trachyphylla)*
5. Chewings fescue	*Festuca rubra* ssp. *commutata (*ssp*. fallax)*
6. Creeping bentgrass	*Agrostis stolonifera*
7. Colonial bentgrass	*Agrostis capillaris*
8. Strong creeping red fescue	*Festuca rubra* ssp. *rubra*
9. Slender creeping red fescue	*Festuca rubra ssp. litoralis*
10. Velvet bentgrass	*Agrostis canina*
11. Rough bluegrass	*Poa trivialis*
12. Annual bluegrass	*Poa annua*
13. Annual ryegrass	*Lolium multiflorum*

Warm Season grasses

14. Japanese / Korean lawngrass	*Zoysia japonica*
15. Manilla grass	*Zoysia matrella*
16. Hybrid bermudagrass	*Cynodon dactylon* X *C. transvaalensis*
17. Common bermudagrass	*Cynodon dactylon*
18. Centipedegrass	*Eremechloa ophiuroides*

19. Seashore paspalum	*Paspalum vaginatum*
20. Buffalograss	*Buchloe dactyloides*
21. St. Augustinegrass	*Stenotaphrum secundatum*
22. Kikuyugrass	*Pennisetum clandestinum*
23. Bahiagrass	*Paspalum notatum*

Addendum 2

Weeds

Alkaligrass	*Puccinella distans*
Barnyardgrass / Watergrass	*Echinochloa crus-galli*
Bedstraw / Catchweed	*Galium aparine*
Bindweed, Field	*Convolvulus arvensis*
Brassbuttons, Souther	*Cotula australis*
Buttonweed, Virginia	*Diodia virginia*
Carpetweed	*Mollugo verticillata*
Carrot, Wild	*Daucus carota*
Chess, Soft	*Bromus hordeaceus*
Chickweed, Common	*Stellaria media*
Chickweed, Mouseear	*Cerastium vulgatum*
Chicory	*Cichorium intybus*
Clover, White	*Trifolium repens*
Crabgrass, Hairy (Large)	*Digitaria sanguinalis*
Crabgrass, Smooth	*Digitaria ischaemum*
Cudweed, purple	*Gnaphalium purpureum*
Dallisgrass (smooth paspalum)	*Paspalum dilatatum*
Dandelion, False /spotted catsear	*Hypochoeris radicata*
Dandelion	*Taraxacum officinale*
Dichondra	*Dichondra repens*
Dock, Curly	*Rumex crispus*
Downy Brome / cheatgrass	*Bromus tectorum*
English Daisy	*Bellis perennis*
Foxtail, Yellow (pigeon / bristle grass)	*Setaria glauca (pumilla ssp pumilla)*
Foxtail , Green	*Setaria viridis*
Garlic , Wild	*Allium vineale*
Geranium, Carolina / dovefoot	*Geranium ssp.*
Goosegrass/Silver Crab/ Crowfoot	*Elusine indica*
Ground Ivy (Creeping Charlie/Jenny)	*Glechoma hederacea*
Hawkweed	*Hieracium pratense*
Henbit	*Lamium amplexicaule*
Johnsongrass	*Sorghum halapense*
Kikuyugrass	*Pennisetum clandestinum*

Knotweed, Prostrate / Common	*Polygonum aviculare*
Kochia	*Kochia scoparia*
Kyllinga, Annual / Fragrant	*Kyllinga odorata*
Kyllinga, Green / Perennial	*Kyllinga brevifolia*
Lambsquarter	*Chenopodium album*
Lettuce, Prickly	*Lactuca serriola*
Mallow, Common	*Malva neglecta*
Medic, Black	*Medicago lupulina*
Moss, silvery thread	*Bryum argenteum*
Mullein, Common	*Verbascum thapsus*
Nimblewill	*Muhlenbergia schreberi*
Nutsedge, Purple	*Cyperus rotundus*
Nutsedge, Yellow	*Cyperus esculentus*
Oats, Wild	*Avena fatua*
Orchardgrass	*Dactylis glomerata*
Pearlwort	*Sagina apetala (procumbens)*
Pennywort / dollarweed	*Hydrocotyle umbellate*
Peppergrass / pepperweed	*Lepidium virginicum*
Pigweed, Prostrate	*Amaranthus blitoides*
Pineapple Weed / wild chamomile	*Matricaria discoidea*
Plaintain, Broadleaf	*Plantago major*
Plantain, Buckhorn / Narrowleaf	*Plantago lanceolata*
Puncture Vine / goatshead	*Tribulus terrestris*
Purslane, common	*Portulaca oleracea*
Quackgrass	*Elytrigia repens*
Rattail fescue	*Vulpia myuros*
Redtop	*Agrostis gigantean (alba)*
Salsify, Western	*Tragopogon dubius*
Sandbur/ grassbur	*Cenchrus incertus*
Sedge, Annual	*Cyperus compressus*
Shepherd's Purse	*Capsella bursa-pastoris*
Signalgrass	*Urochloa subquadripara*
Smartweed, Spotted (Ladysthumb)	*Polygonum persicaria*
Smutgrass	*Sporobolus indicus*
Sorrell, Red / Sheeps	*Rumex acetosella*
Speedwell, creeping	*Veronica filiformis*
Spurge, Prostrate / Spotted	*Chamaesyce maculata (Euphorbia)*
Star of Bethlehem	*Ornithogalum umbellatum*
Strawberry, Wild	*Fragaria virginiana*
Swinecress	*Coronopus didymus*
Thistle, Bull	*Cirsium vulgare*

Thistle, Canada	*Cirsium arvense*
Thistle, Musk	*Carduus nutans*
Torpedograss	*Panicum repens*
Velvetgrass, German	*Holcus mollis*
Violet	*Viola ssp.*
Woodsorrel, Creeping	*Oxalis corniculata*
Woodsorrel, Yellow (Oxalis)	*Oxalis stricta*
Yarrow	*Achillea millefolium*
Yellowcress	*Rorippa palustris*

Addendum 3

Bacterial Diseases

Bacterial wilt	*Xanthomonas translucens*
Bacterial etiolation and decline	*Acidovorax avenae*

Fungal Diseases

Anthracnose	*Colletotrichum cereale, C. eremochloae*
Ascochyta leaf blight	*Ascochyta avenae*
Bermudagrass decline	See Root decline of warm-season grasses
Blister smut	*Jamesdicksonia dactylidis*
Brown patch **(**C3) & large patch (C4)	*Rhizoctonia solani*
Brown ring patch	*Waitea circinata* var. *circinata*
Brown stripe	*Mycosphaerella recutita*
Cladosporium eyespot	*Cladosporium phlei*
Copper spot	*Gloeocercospora sorghi*
Coprinus snow mold	*Coprinopsis psychromorbida*
Crown rust	*Puccinia coronata*
Curvularia blight	multiple *Curvularia sp.*
Dead spot	*Ophiosphaerella agrostis*
Dollar spot	*Clarireedia* is new genus *Clarireedia homeocarpa* on *Festuca rubra,* UK only *Clarireedia bennettii* on mostly cool season grasses, UK, Netherlands, USA *Clarireedia monteithiana* on Warm-season grasses; found worldwide *Clarireedia jacksonii* on cool-season grasses; found worldwide
Drechslera leaf spots and melting-out	multiple *Drechslera* and *Marielliottia sp.*
Endophytic fungi	*Neotyphodium coenophialum, N. lolii, Epichloe typhina*
Fairy ring	Species of Agraricales and Gastromycetales, mostly in the genera *Agaricus, Calvatia,*

	Chlorophyllum, Clitocybe, Lepiota, Lycoperdon, Marasmius, Scleroderma, and *Tricholoma*.
Flag smut	*Urocystis agropyri*
Gray leaf spot	*Pyricularia grisea*
Gray snow mold	*Typhula incarnata*
Leaf and sheath spot	*Waitea circinata var. zeae, W. circinata var. oryzae*
Leaf rust	*Puccinia brachypodii*
Leptosphaerulina leaf blight	*Leptosphaerulina trifolii*
Mastigosporium leaf spot (leaf fleck)	*Mastigosporium rubricosum*
Microdochium patch	*Microdochium nivale*
Necrotic ring spot	*Ophiosphaerella korrae*
Phyllosticta leaf blight	Multiple species of *Phyllosticta* and *Guignardia*
Physoderma leaf spot and leaf streak	*Physoderma graminis*
Pink patch and cream leaf blight	*Limonomyces roseipellis*
Pink snow mold	See Microdochium patch
Powdery mildew	*Blumeria graminis*
Pythium foliar blight	*Pythium aphanidermatum*, *P. graminicola*, *P. ultimum, Several other Pythium species*
Pythium root and crown rot	*Pythium aristosporum*, *P. arrhenomanes*, *Pythium volutum, several other Pythium species*
Pythium root dysfunction:	*Pythium volutum*, *P. arrhenomanes*, *P. aristosporum, several other Pythium species*
Rapid blight	*Labyrinthula terrestris*
Red thread	*Laetisaria fuciformis*
Root decline of warm-season grasses	*Gaeumannomyces graminis* var. *graminis, Magnaporthiopsis incrustans, G. wongoonoo*
Septoria leaf spot	several *Septoria* species
Snow scald	*Sclerotinia borealis*
Southern blight	*Athelia rolfsii*
Speckled snow mold	*Typhula ishikariensis*
Spring dead spot	*Ophiosphaerella narmari, O. korrae, O. herpotricha*
Stem rust	*Puccinia graminis*
Stripe rust	*Puccinia striiformis*
Stripe smut	*Ustilago striiformis*
Summer patch	*Magnaporthiopsis poae*
Take-all patch	*Gaeumannomyces graminis*
Tar spot	*Phyllachora* spp.
Thatch collapse	*Sphaerobollus stellatus*
Yellow patch	*Rhizoctonia cerealis*
Yellow tuft	*Sclerophthora macrospora* .
Yellow ring	*Trechispora alnicola*

Nematodes, Parasitic

Awl**:** *Dolichodorus* spp. Cobb
Cyst**:** *Heterodera* spp. Schmidt
Dagger**:** *Xiphinema* spp. Cobb
Lance**:** *Hoplolaimus* spp. Daday
Lesion**:** *Pratylenchus* spp. Filipjev
Needle**:** *Longidorus* spp. (Micoletzky) Thorne & Swanger
Pin**:** Paratylenchus spp.
Pseudo-root knot**:** *Hypsoperine* spp. Sledge & Golden
Ring**:** Criconemella, Criconemoides, *Macroposthonia,* and *Mesocriconema* spp.
Root gall**:** *Subanguina* spp.
Root knot**:** *Meloidogyne* spp. Goeldi
Sheath**:** *Hemicycliophora* spp.
Sheathoid**:** *Hemicriconemoides* spp.
Spiral**:** *Helicotylenchus* spp. Steiner
Sting**:** *Belonolaimus* spp. Steiner
Stubby root**:** *Paratrichodorus* and *Trichodorus* spp.

Stylet or stunt**:** *Tylenchorhynchus* spp. Cobb

Miscellaneous Diseases or Disorders

Black Layer**:** A
Anaerobic soil plus blue-green algae and/or sulfate-reducing bacteria
Slime Molds (superficial, not pathogenic)**:**
Mucilago crustacea
: *Didymium squamulosum*
: *Physarum cinereum*.
: Species of *Physarum* and *Fuligo*

Addendum 4:

Insects

annual bluegrass weevil

billbugs

- bluegrass billbug
- hunting billbug

black turfgrass ataenius

chinchbugs

- hairy chinchbug

- southern chinchbug

craneflies

- European cranefly *(Tipula paludosa)*
- "common" cranefly *(Tipula oleraceae)*

Caterpillars and adults

- armyworm
- black cutworm
- fall armyworm
- winter cutworm

mole crickets

- southern mole cricket
- tawny mole cricket

red imported fire ant

turfgrass ant

white grubs

- Asiatic garden beetle
- European chafer
- Japanese beetle
- masked chafer (southern)
- masked chafer (northern)
- oriental beetle

Wasps

- Scoliid
- Cicada Killers
- yellow jacket
- Paper wasp

Beneficials

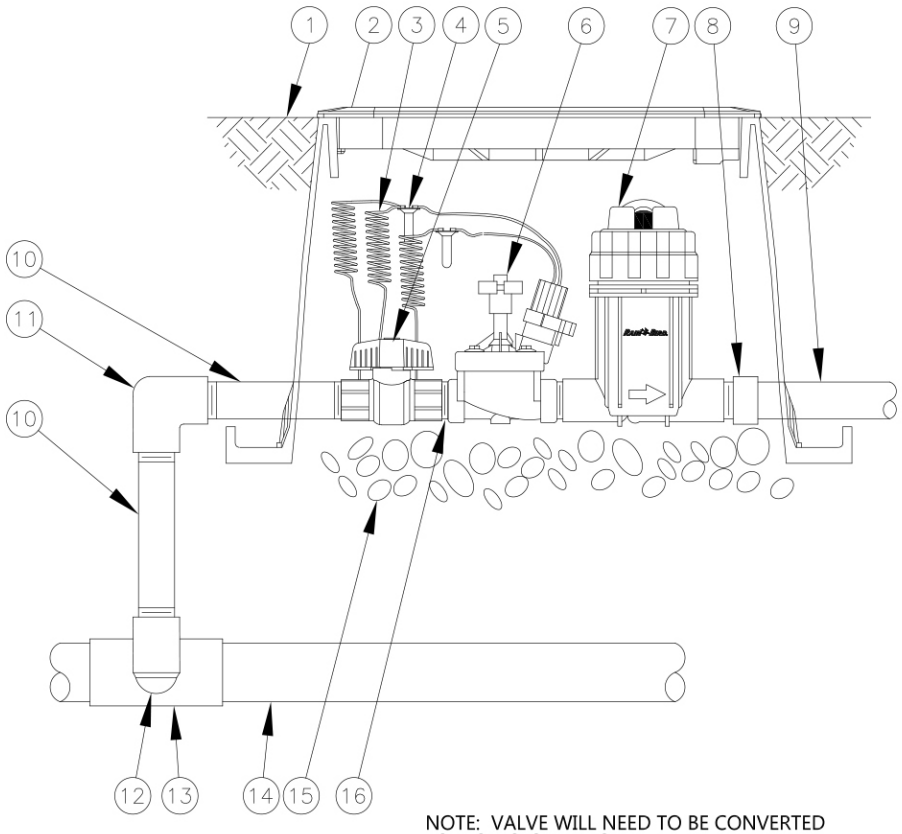
Honey bees

Assassin bugs

Ground beetle

Lacewing

Praying Mantis



NOTE: VALVE WILL NEED TO BE CONVERTED FOR ICM SYSTEM USE.

1. FINISH GRADE/TOP OF MULCH
2. VALVE BOX WITH COVER: RAIN BIRD VB-STD
3. 30-INCH LINEAR LENGTH OF WIRE, COILED
4. WATERPROOF CONNECTION: RAIN BIRD DB SERIES
5. 1-INCH BALL VALVE (INCLUDED IN KIT)
6. REMOTE CONTROL VALVE: RAIN BIRD PESB (INCLUCED IN XCZ-100-PRB-COM KIT)
7. PRESSURE REGULATING QUICK CHECK BASKET FILTER: RAIN BIRD PRB-QKCHK-100 (INCLUDED IN XCZ-PRB-100-COM KIT)
8. PVC SCH 40 FEMALE ADAPTOR
9. LATERAL PIPE
10. PVC SCH 80 NIPPLE (LENGTH AS REQUIRED)
11. PVC SCH 40 ELL
12. PVC SCH 80 NIPPLE (2-INCH LENGTH, HIDDEN) AND PVC SCH 40 ELL
13. PVC SCH 40 TEE OR ELL
14. MAINLINE PIPE
15. 3-INCH MINIMUM DEPTH OF 3/4-INCH WASHED GRAVEL
16. PVC SCH 80 NIPPLE, CLOSE (INCLUDED IN XCZ-PRB-100-COM KIT)

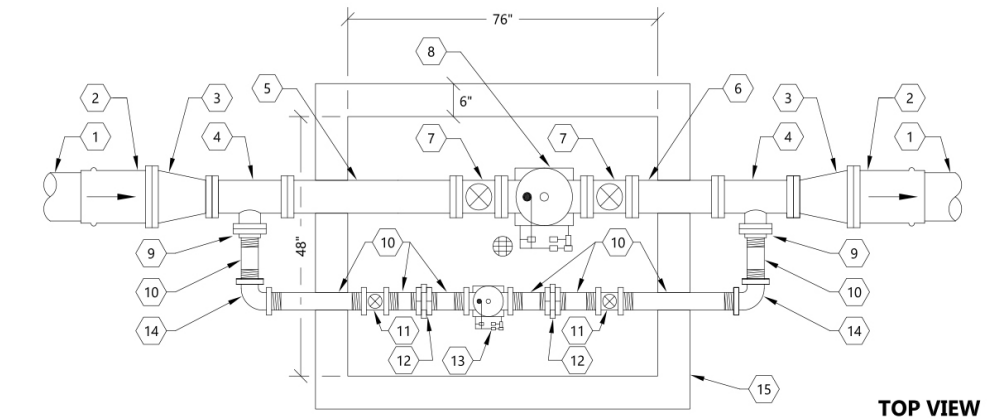
1" DRIP CONTROL VALVE

NTS

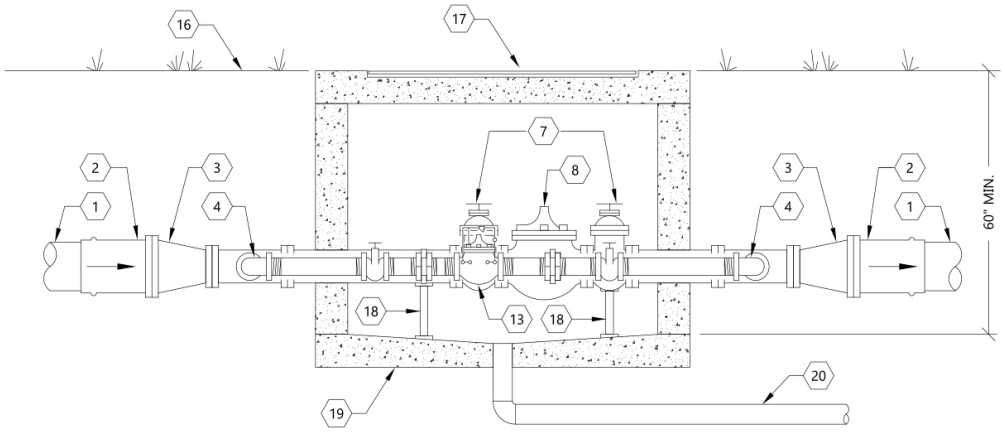
(FIELD LOCATE APPROX. 3 OF THESE COMPONENTS AT SELECTED BUNKERS)

16

	RAIN BIRD	XCZ-100-PRB-COM	1" DRIP VALVE KIT (INCLUDE 500' OF RAIN BIRD XFS-06-12-500 SUB-SURFACE DRIPLINE WITH EACH VALVE KIT FOR BUNKERS)



TOP VIEW



SIDE VIEW

NOTES:

1. GAUGES SHALL BE INSTALLED SO THEY CAN BE READ FROM THE TOP.
2. CONTRACTOR TO SUBMIT SHOP DRAWINGS OF VAULT.
3. PRV TO BE LOCATED OUTSIDE OF TURF.

1. HDPE DISTRIBUTION PIPING LINE
2. D.I. FLG. x HDPE ADAPTER
3. D.I. FLG. x FLG. REDUCER (IF REQUIRED)
4. D.I. REDUCING TEE (FLG. x FLG.)
5. D.I. FLANGED SPOOL (LENGTH AS REQ.)
6. D.I. FLANGED SPOOL (LENGTH AS REQ.)
7. AMERICAN FLOW CONTROL SERIES #2500 GATE VALVE W/HANDWHEEL.
8. CLAYTON #694G-25BCSY-KC PRESSURE REDUCING AND SURGE CONTROL VALVE WITH LOW PRESSURE SHUTDOWN W/ GUAGES TO READ UPSTREAM AND DOWNSTREAM PRESSURES.
9. D.I. THREADED ADAPTER
10. 2" BLACK IRON OR BRASS NIPPLE (LENGTH AS REQ.)
11. NIBCO #T-113 IRR-BHW 2" GATE VALVE WITH CAST BRONZE HANDWHELL.
12. 2" BLACK IRON OR BRASS UNION
13. 2" CLAYTON #94G-25BCSY-KC PRESSURE REDUCING AND SURGE CONTROL VALVE WITH LOW PRESSURE SHUTDOWN W/GUAGES TO READ UPSTREAM AND DOWNSTREAM PRESSURES.
14. 2" BLACK IRON OR BRASS 90 ELL
15. CONCRETE VAULT BUILT-UP OR POURED IN PLACE. UTILITY VAULT #575-WA
16. FINISH GRADE
17. LOCKING STEEL COVER. UTILITY VAULT #57-3660
18. FLOOR SUPPORTS (TYPICAL OF FOUR)
19. CONCRETE FLOOR (SLOPE TO DRAIN)
20. 4" PVC PIPE (EXTEND TO EITHER FAIRWAY DRAINAGE OR NEARBY WASH OR LAKE).

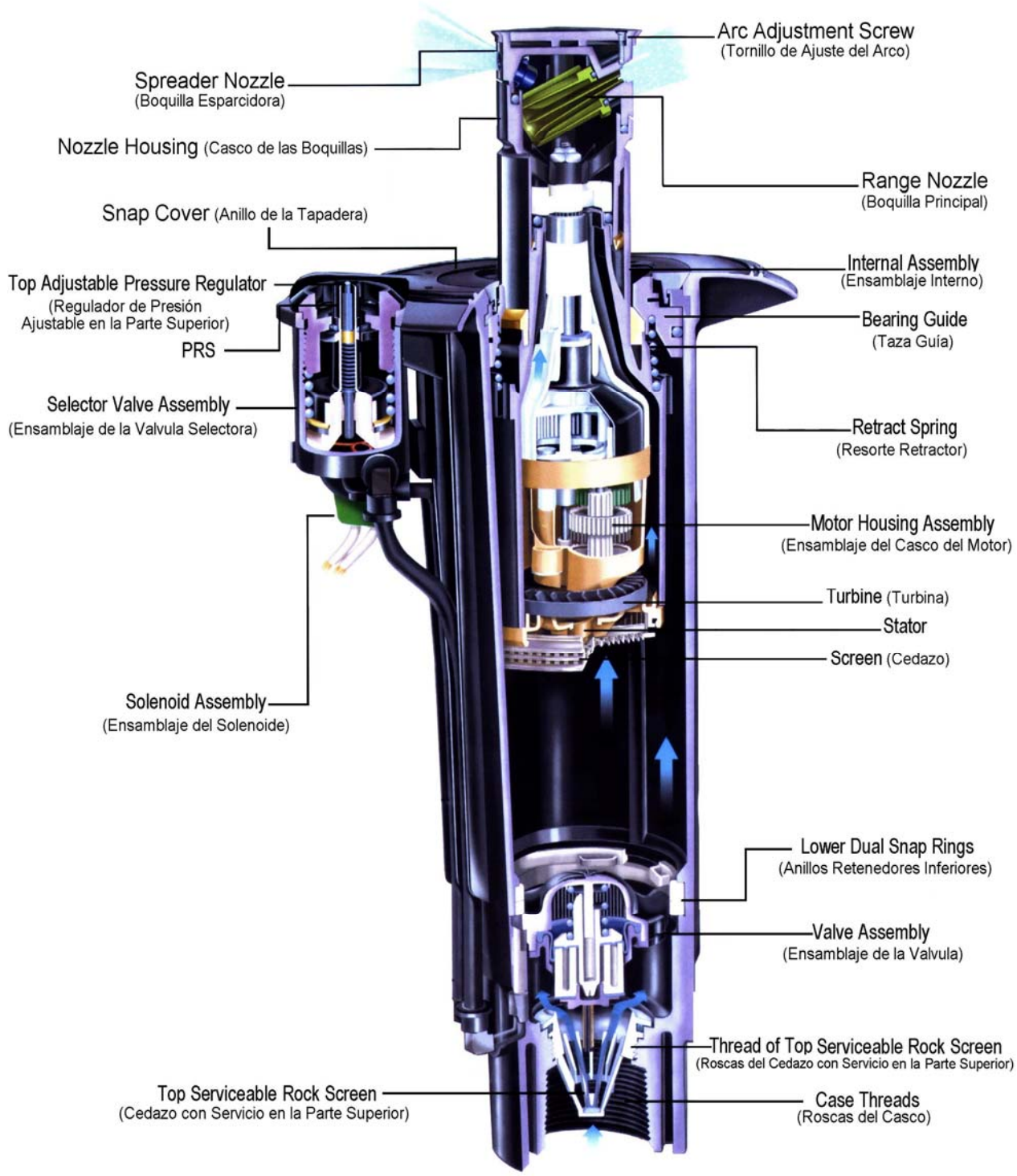
PRESSURE REGULATING VALVE FOR HOLES 5,6,7,8

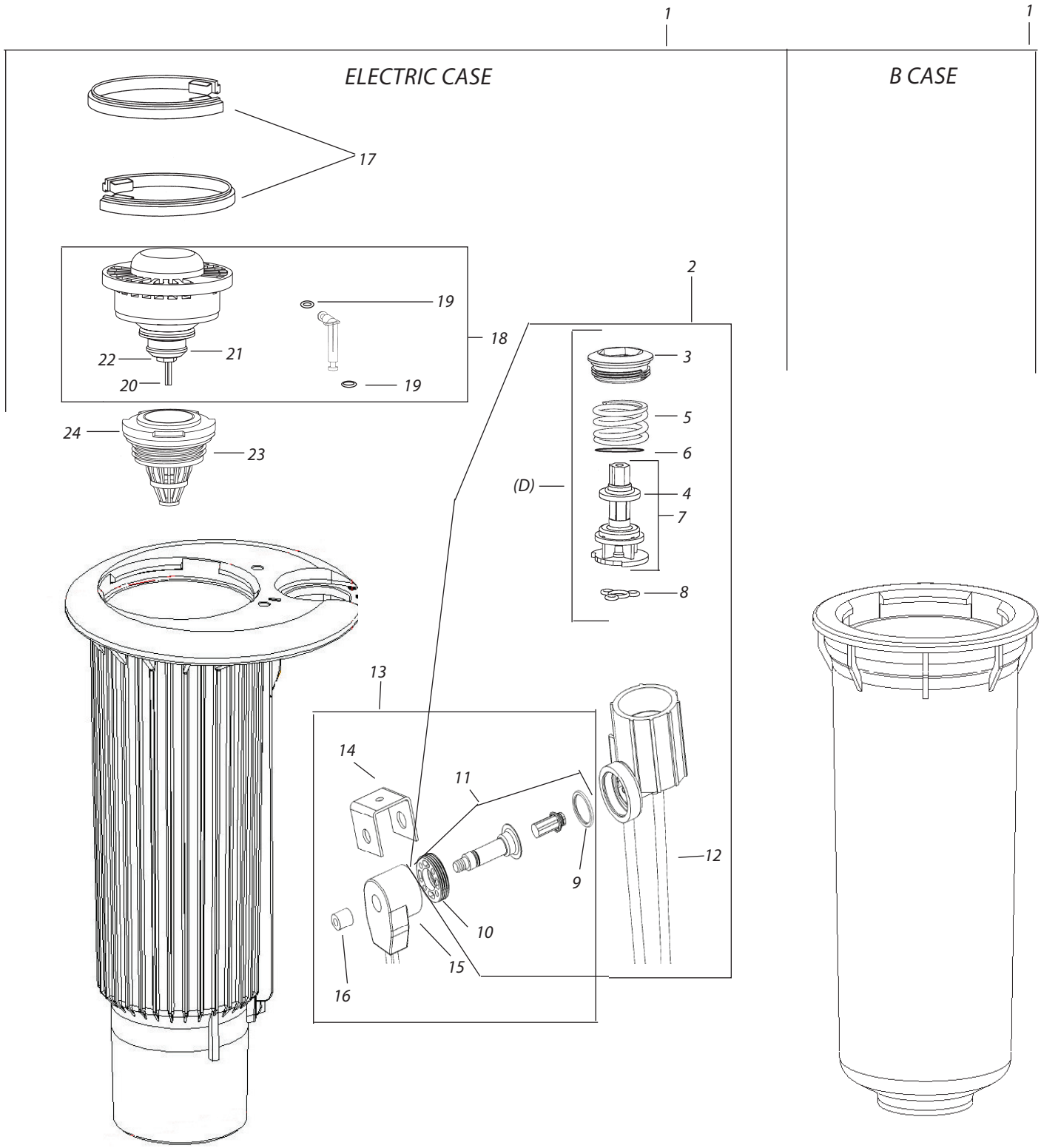
NTS

17

⋈	CLA-VAL	#694G-25BCSY-KC	SEE SHEET I-2 FOR SIZING W/2" BYPASS

Cutaway of Eagle 700 Rotor (Vista Interior del Rotor Eagle 700)





Note: Part numbers enclosed in brackets ( ) are not available individually, but may be sold in assemblies or kits.

Ref.	Part Description	Qty.	Electric	SAM/Hydraulic	B case
CASE ASSEMBLIES					
EAGLE 700 / 750					
1	Case Assembly (NPT)	1	(A) –	(A) –	211489-01
–	Case Assembly (BSP)	1	(B) 212462-xx	212464	211489-02
–	Case Assembly (ACME)	1	(B) 212466-xx	212468	211489-03
EAGLE 500 / 550					
1	Case Assembly (NPT)	1	(A) –	–	211489-01
–	Case Assembly (BSP)	1	(B,C) –	212464	211489-02
–	Case Assembly (ACME)	1	(B,C) –	212468	211489-03
2	PRS/Selector Housing Assy (>6/95)	1	211418	–	–
3	Selector Cap	1	(D)	–	–
4	Stem Cover O-Ring	1	(D)	–	–
5	Compression Spring	1	(D)	–	–
6	Selector Spring Washer	1	(D)	–	–
7	PRS Cartridge, Upper Stem (Black)	1	(D)	–	–
8	Selector Seal (Green)	1	(D,F) 212244	–	–
9	Solenoid Base O-Ring	1	211237	–	–
10	Base Nut	1	602606	–	–
11	Plunger Core Tube Assy	1	(G)212972-01S	–	–
12	Tubing	2	(E)211607	(E)211607	–
13	Solenoid Assy	1	206920-01	–	–
14	U-Frame	1	212124S	–	–
15	Encapsulated Coil	1	602118	–	–
16	Solenoid Retainer	1	627167	–	–
17	Lower Snap Ring	2	210470	210470	–
18	Valve Assembly (700 / 750 Series)	1	211468	212322	–
18	Valve Assembly (500 / 550 Series)	1	212089S	212322	–
19	Probe O-Ring	2	211238	211238	–
20	Universal Filter	1	206092-02	–	–
21	Inlet Rubber Seal	1	212328S	212221	–
22	Seal Nut	1	211174	–	–
23	Top-Serviceable Rock Screen (TSRS) (>4/98) (White)	1	211714-01	211714-01	–
24	O-Ring for TSRS (Yellow)	1	210366	210366	–
KITS					
–	ACME Case (with elbows and TSRS only)	1	212479	–	–
–	Tubing Repair Kit (E)	1	211607	–	–
–	Quick Connects for Tube Cuts	1	212159	–	–
–	Rubber Cover Kit (B case Only)	1	–	–	211355
–	Rubber Cover Kit (500/550/700/750) - Smooth Case Rotor	1	211602	211602	–
–	Rubber Cover Kit (500/550/700/750) - Ribbed Case Rotor	1	212551	212551	–
TOOLS - For use on 500/550/700/750 Rotors					
–	Selector Service Tool Key (Orange Tool)	1	B41720	–	–
–	7" Selector Valve Key	1	D02215	–	–
–	18" Selector Valve Key	1	D02221	–	–
–	Snap Ring Pliers	1	D02236	D02236	D02236
–	Valve Insertion Tool	1	B41710	B41710	–
–	Installation Socket for TSRS	1	D02237	D02237	D02237
-	Universal Hose Adaptor	1	D05205	D05205	–

(A) 1 1/4" NPT cases not available. Upgrade to ACME case w/NPT to ACME adatper (212947S).

(B) For Electric Case Assemblies specify pressure setting when ordering. -01 corresponds to 60psi (4,1 bars), -02 = 70 psi (4,8 bars), -03 = 80 psi (5,5 bars), and -04 = ~100psi (~6,9 bars). Pressure settings are identified as follows: 60PSI-Black, 70PSI-Blue, 80PSI-White,100PSI-Red.

(C) Use EAGLE 700/750 case assembly and replace valve with 500/550 valve assembly (212089S)

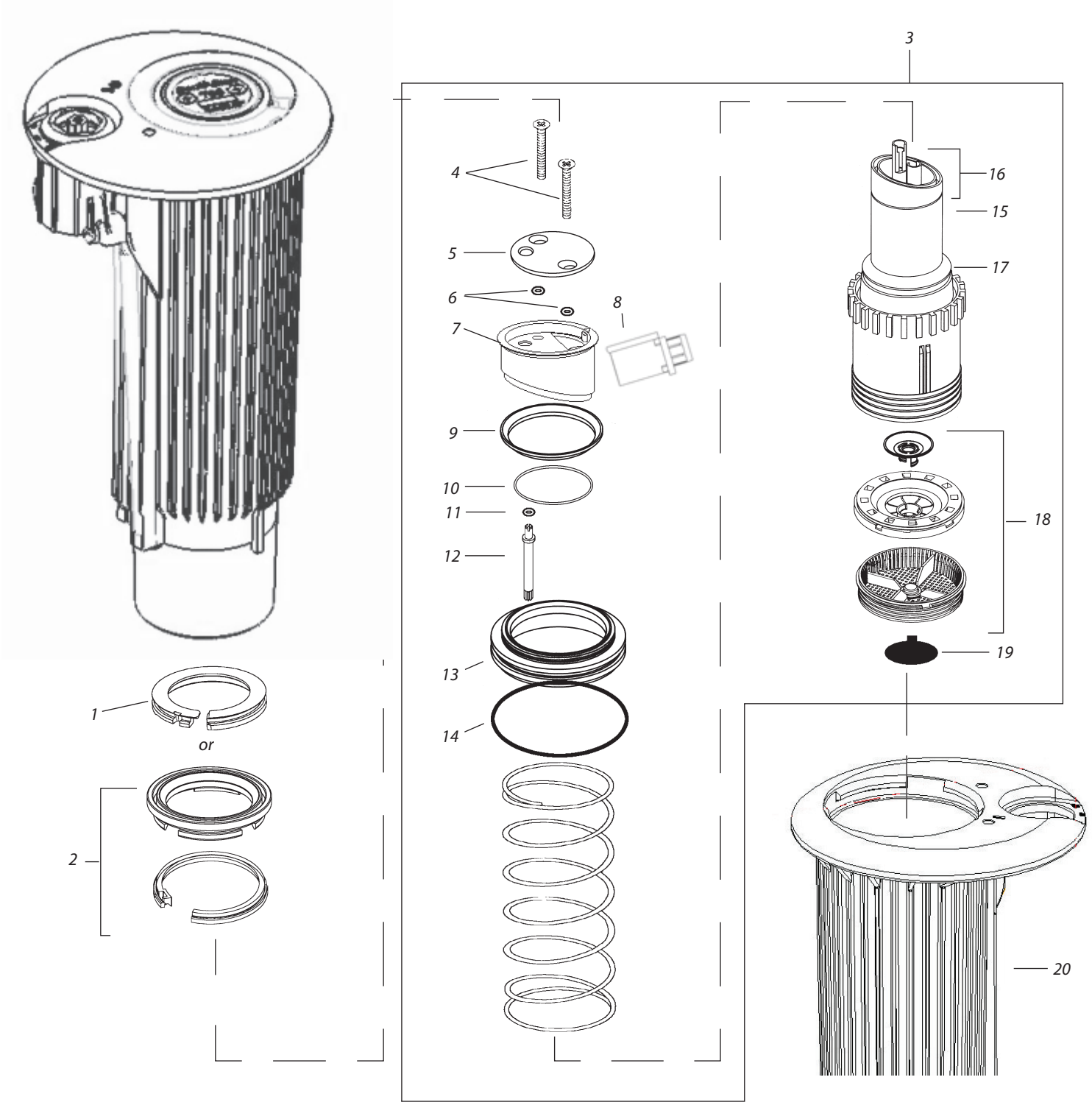
(D) Included in PRS/Selector Repair Kit: Pre 4/01 use # 210166 (includes rust seal.), Post 4/01 use #212150 (includes green seal).

(E) Tubing Repair Kit includes 20 tubes, ferrules and metal barbs.

(F) Selector Seal, Rust (<4/01) #211663

(G) For salt water Plunger Core Tube Assy - use Part # 212732

Note: Part numbers enclosed in brackets ( ) are not available individually, but may be sold in assemblies or kits.



Note: Part numbers enclosed in brackets ( ) are not available individually, but may be sold in assemblies or kits.

TO BUY GENUINE RAIN BIRD PARTS, CONTACT YOUR LOCAL DISTRIBUTOR OR VISIT OUR ONLINE STORE AT WWW.RAINBIRD.COM

Ref.	Part Description	Qty.	750-E	750-S/H	750B
	SNAP RINGS				
1	Snap Cover (excluding BRC)	1	211921-01	211921-01	211921-01
2	Rubber Cover Kit	1	212552	212552	211355
	INTERNAL ASSEMBLY				
3	Internal Assembly (A)	1	211544-xx	211544-xx	(F)211544-xx
	COVER ASSEMBLY				
4	Self-Tapping Screw	2	210974	210974	210974
5	Housing Cover	1	210355	210355	210355
6	Cover Screw O-Ring	2	211236	211236	211236
	NOZZLES				
7	Dual-Spreader™ Nozzle Housing(B)(D)	1	211982-01	211982-01	211982-01
8	Range Nozzle Assembly	1	213750-xx	213750-xx	213750-xx
9	Retract Seal	1	210354	210354	210354
18	Stator/Screen Kit	1	210403-01	210403-01	210403-01
	-Stator	1	–	–	–
	-Poppet	1	–	–	–
	-Screen	1	–	–	–
19	Seal-a-Matic™ Screen Assy (B/BRC Only)	1	–	–	211292
	BEARING / RISER-MOTOR ASSEMBLY				
10	Nozzle Housing O-Ring	1	210366	210366	210366
11	Arc Adjustment Stem O-Ring	1	211236	211236	211236
12	Arc Adjustment Stem	1	210420	210420	210420
13	Bearing Guide Assy, STD	1	211147	–	–
13	Bearing Guide Assy, LO-FLOW (C)	1	–	211263	211263
14	Bearing Guide O-Ring	1	211242	211242	211242
15	Riser Motor Assembly	1	210535	210535	210535
16	Nozzle Base Replacement Kit w/ Seals	1	211841	211841	211841
17	Pop-up Seal (White)	1	210399	210399	210399
20	CASE ASSEMBLY See Catolog No. 464				

(A) Specify Nozzle Size when ordering. Available in # 28, 32, 36, 40, 44, 48. To replace cascade nozzles (#14-24), double the nozzle number and upgrade to dual spreader nozzles. (eg. for #18 cascade, order #36 dual spreader.)

(B) For non-potable applications use standard part and purple snap ring (Part # 211921-04)

(C) The LO-FLOW Bearing Guide #211263 may also be used on the 750 Series Electric rotors.

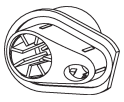
(D) For casade nozzle housing upgrade to Dual-Spreader™ nozzle housing - Part # 211982-01 and Nozzle - part # 213750-xx

(E) For smooth case rotors use Part # 211602

(F) Also requires Seal-O-Matic™ Screen Assy (B/BRC)-Part # 211292

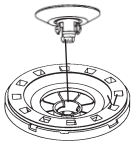
Ref.	KITS & Accessories	Qty.	P/N
1	Snap-Cover, Yellow		211921-02
1	Snap-Cover, White		211921-03
1	Snap-Cover, Purple (Non-Potable)		211921-04
	Rubber Cover Kit (E/H/S)		(E)212551
2A	Rubber Cover, Snap Ring	1	
2B	Snap Ring, Upper	1	
5	Rubber Cover, Housing	1	
–	Rubber Case Cover (E/H/S)	1	
	Rubber Cover Kit (B & BRC)		211355
2A	Rubber Cover, Snap Ring	1	
2B	Snap Ring, Upper	1	
5	Rubber Cover, Housing	1	
–	Rubber Case Ring (B case)	1	
5	Cover, Yardage Marker Blank (White)		211996-03
5	Cover, Yardage Marker Blank (Black)		211996-01
	Diffuser Screw Kit, Dual Spreader (B) (Without Nozzle)		212295
7	Nozzle Housing, Drilled & Tapped	1	
–	Diffuser Screw (not shown)	1	
5	Housing Cover (Notched)	1	
9	Retract Seal	1	
6	Cover Screw O-Ring	2	
	EAGLE'S TAIL KITS		
–	Dual-Spreader (without nozzle) (Black)		212287
7	Housing, Nozzle, Drilled in back	1	
–	Close-in Spreader Nozzle, 700	1	211452
5	Housing Cover	1	
9	Retract Seal	1	
6	Cover Screw O-Ring	2	
–	EAGLE's Tail Instruction Sheet	1	

750 Dual-Spreader Nozzle



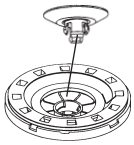
750 Cascade Nozzle (obsolete)

Stator with Poppet Closed



Should be tight when snapped in

Stator with Poppet Open



Should be loose when snapped in

Stator / Poppet Configurations - Dual-Spreader & Cascade

Color	Number	Electric Pressure Setting psi (bars) 60 (4,1)	70 (4,8)	80 (5,5)	100 (6,9)	Hyd, SAM, B
White	28/14C	SPC	SPC	SPC	SPC	SPC
Blue	32/16C	SPO	SPO	SPO	SPO	SPO
Yellow	36/18C	SPO	SPO	SPO	SPO	SPO
Orange	40/20C	SNP	SNP	SNP	SNP	SNP
Green	44/22C	SNP	SNP	SNP	SNP	SNP
Black	24C	SNP	SPR	SPR	SPR	SNP
Black	#48	SPR	SPR	SPR	SPR	SNP

SPC = Stator with Poppet Closed
SPO = Stator with Poppet Open
SNP = Stator No Poppet and Nozzle Setting
SPR = Spacer and Screen
N/R=Not a Recommended Pressure

Note: Part numbers enclosed in brackets ( ) are not available individually, but may be sold in assemblies or kits.