No. 201900299

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Clemson University Research Foundation

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

An application requesting a certificate of protection for an alleged novel variety of sexually reproduced, asexually reproduced, or tuber propagated plant, the name and description of which are contained in the application and exhibits, a copy of which is hereunto annexed and made a part hereof, and the various requirements of law in such cases made and provided have been complied with, and the title thereto is, from the records of the PLANT VARIETY PROTECTION OFFICE, in the applicant(s) indicated in the said copy, and whereas, upon due examination made, the said applicant(s) is (are) adjudged to be entitled to a certificate of plant variety protection under the law.

Now, therefore, this certificate of plant variety protection is to grant unto the said applicant(s) and the successors, heirs or assigns of the said applicant(s) for the term of TWENTY years from the date of this grant, subject to the payment of the required fees and periodic replenishment of viable germplasm material of the variety in a public repository as provided by law, the right to exclude others from selling the variety, or offering it for sale, or reproducing it, or importing it, or exporting it, or conditioning it for propagation, or stocking it for any of the above purposes, for using it in producing a hybrid or different variety there from, to the extent provided by the PLANT VARIETY PROTECTION ACT. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

SORGHUM

'CU16FL159'

In Testimony Whereof, *I have hereunto set my hand and caused the seal of the* Plant Variety Protection Office *to be affixed at the* ***City of Washington, D.C.*** *this thirtieth day of November, in the year* ***two thousand and twenty.***

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

Revised application 4/10/2020

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U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE
(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER
Clemson University

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME
16FL159

3. VARIETY NAME
CU16FL159

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*
230 Kappa Street
Clemson, SC 29634

5. TELEPHONE *(include area code)*
864-656-7701

6. FAX *(include area code)*
864-656-0474

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PVPO NUMBER
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FILING DATE
7/25/2019

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*
Non profit

8. IF INCORPORATED, GIVE STATE OF INCORPORATION

9. DATE OF INCORPORATION

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*
A. Chris Gesswein
391 College Avenue, Suite 401
Clemson, SC 29631

11. TELEPHONE (Include area code)
864-656-0797

12. FAX (Include area code)
864-656-0474

FEES RECD

FILING AND EXAMINATION FEES:
$ 4382.00
DATE 7/25/2019

CERTIFICATION FEE:
$
DATE

13. E-MAIL
agesswe@clemson.edu

14. CROP KIND *(Common Name)*
Sorghum

15. GENUS AND SPECIES NAME OF CROP
Sorghum bicolor

16. FAMILY NAME *(Botanical)*
Poaceae

17. IS THE VARIETY A FIRST GENERATION HYBRID?
☐ YES ■ NO

18. DOES THE VARIETY CONTAIN ANY BIOTECHNOLOGY EVENTS?
☐ YES ■ NO

A biotechnology event is defined as a single insertion of a nucleic acid construct into a specific site in a plant's chromosome that is regulated under the U.S. Coordinated Framework for the Regulation of Biotechnology.

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD ONLY AS A CLASS OF CERTIFIED SEED? *(See Section 83(a) of the Plant Variety Protection Act)*
☐ YES *(If "yes", answer items 21 and 22 below)*
■ NO *(If "no", go to item 23)*
☐ UNDECIDED

19. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow instructions)
a. ■ Exhibit A. Origin and Breeding History of the Variety
b. ■ Exhibit B. Statement of Distinctness
c. ■ Exhibit C. Objective Description of Variety
d. ☐ Exhibit D. Additional Description of the Variety *(Optional)*
e. ■ Exhibit E. Statement of the Basis of the Owner's Ownership
f. ■ Filing and Examination Fee ($4,382),
✓ Make checks and money orders payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*
✓ *Credit Card Payments (See instructions on Page 2 of 11)*

21. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES?
■ YES ☐ NO
IF YES, WHICH CLASSES? ■ FOUNDATION ☐ REGISTERED ☐ CERTIFIED

22. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
■ YES ☐ NO
IF YES, SPECIFY THE NUMBER 1,2,3, etc. FOR EACH CLASS.
X FOUNDATION ___ REGISTERED ___ CERTIFIED
(If additional explanation is necessary, please use the space indicated on next page.)

23. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES?
☐ YES ■ NO
IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. *(Please use space indicated on next page.)*

24. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT *(PLANT BREEDER'S RIGHT OR PATENT)*?
☐ YES ■ NO
IF YES, PLEASE GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. *(Please use space indicated on next page.)*

25. The owners declare that a viable sample of basic seed will be furnished directly to an acceptable depository in support of the variety within three months of filing. Seed will be replenished upon request in accordance with such regulations as may be applicable. For a tuber propagated variety or vegetative propagated parent of the variety, a tissue culture or vegetative sample will be deposited in a public repository within three months of the date of the certificate fee request letter. These will be maintained for the duration of the certificate."

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act. Owner(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF OWNER		SIGNATURE OF OWNER	
NAME *(Please print or type)*		NAME *(Please print or type)*	
CAPACITY OR TITLE	DATE	CAPACITY OR TITLE	DATE

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Continuation Page from ST – 470 (Application for Plant Variety Protection Certificate)

22. CONTINUED FROM FRONT *(Please provide a statement as to the limitation and sequence of generations that may be certified.*

23. CONTINUED FROM FRONT *(Please provide the date of first sale, disposition, transfer, or use for each country and the circumstances, if the variety (including any harvested material) or a hybrid produced from this variety has been sold, disposed of, transferred, or used in the U.S. or other countries.)*

24. CONTINUED FROM FRONT *(Please give the country, date of filing or issuance, and assigned reference number, if the variety or any component of the variety is protected by intellectual property right (Plant Breeder's Right or Patent).)*

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INBRED SORGHUM LINE 'CU16FL159'

Exhibit A. Origin and Breeding History

Inbred sorghum restorer line 'CU16FL159' was developed from a cross between female parent SC103 (PI 533752) and male parent SC372 (PI 533878). The cross was made using plastic bag emasculation in Puerto Vallarta, Mexico in winter of 2013-2014. SC103 is a converted line released by the Sorghum Conversion Program in 1977 that was derived from a converted of caudatum from South Africa. SC103 has a purple plant color, red pericarp, pigmented testa, compact panicle, and anthracnose resistance. SC372 is also a converted line released by the Sorghum Conversion Program in 1974. SC372 is photoperiod-insensitive, dwarf line of a kaura type sorghum from Nigeria. SC372 has a purple plant color, white pericarp, yellow endosperm, absent (unpigmented) testa, and semi-compact panicle.

The segregating population of SC103/SC372 was part of the Clemson University grain sorghum breeding program. The pedigree breeding method was used for line development, and single plant selections were completed as follows: F_1 — Blackville SC (self-pollinated), F_2 — Puerto Vallarta (open-pollinated), F_3 — Blackville SC (open-pollinated), F_4 — Puerto Vallarta (self-pollinated), F_5 — Florence SC (open-pollinated), and F_6 — Puerto Vallarta (self-pollinated). Selection in all environments was based on white pericarp color, absent testa, short plant height, semi-compact panicle architecture, and anthracnose resistance. In the F_4 generation, this line was determined to be a restorer of sterility in the A1 cytoplasm system using A.Tx2928 as the female parent for A1 cytoplasm. The use of 'CU16FL159' as a potential seed parent was evaluated by crossing to A.Tx2928. 'CU16FL159' has been subsequently reproduced for two generations to evaluate uniformity and has shown to be stable for all traits as described in Exhibit C (Objective Description of Variety). Based on two years of field evaluation, it appears that 'CU16FL159' does not possess the unstable Dw3 allele that gives rise to tall mutant plants.

Season	Gener-ation	Location	Designation	Pedigree (of plants grown in field)	Heads Saved
Winter 2013-14	F_0	Puerto Vallarta, MX	SKseed05266	F_1 cross made	1
Summer 2014	F_1	Blackville, SC	BL14_006	SC103 / SC372	3
Winter 2014-15	F_2	Puerto Vallarta, MX	PV15_485	(SC103 / SC372)-BL14	13
Summer 2015	F_3	Blackville, SC	15BL366-2	(SC103 / SC372)-BL14-PV15	58
Winter 2015-16	F_4	Puerto Vallarta, MX	PV16_3108-3	(SC103 / SC372)-BL14-PV15-BL15	4
Summer 2016	F_5	Florence, SC	16FL159-2	(SC103 / SC372)-BL14-PV15-BL15-PV16	2
Winter 2016-17	F_6	Puerto Vallarta, MX	16FL159 (PV17_224)	(SC103 / SC372)-BL14-PV15-BL15-PV16-FL16	1
Winter 2017-18	F_7	Puerto Vallarta, MX	16FL159 (PV18_0002)	(SC103 / SC372)-BL14-PV15-BL15-PV16-FL16-PV17	Bulk
Summer 2018	F_8	Florence, SC	16FL159 (FL18_0620)	(SC103 / SC372)-BL14-PV15-BL15-PV16-FL16-PV17-PV18	Bulk

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Exhibit B. Statement of Distinctness

'CU16FL159' is most similar to the variety PHB86. Like PHB86, 'CU16FL159' is awnless, does not possess a pigmented testa, has a mid-stout stalk with a sweet and juicy pith, has a waxy bloom, has a medium panicle exsertion, and has a semi-compact panicle shape. Leaves of 'CU16FL159' resemble those of PHB86 in that they are horizontal with a moderate width and intermediate midrib color; 'CU16FL159' leaves are different than PHB86 in that they are darker green and have a smoother margin. Contrastingly, 'CU16FL159' has a white pericarp color compared to the red pericarp of PHB86. Of importance, 'CU16FL159' demonstrates stronger resistance to anthracnose than PHB86, which has intermediate anthracnose resistance.





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U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE

EXHIBIT C

OBJECTIVE DESCRIPTION OF VARIETY SORGHUM AND RELATED CROPS

NAME OF APPLICANT (S)	TEMPORARY OR EXPERIMENTAL DESIGNATION	VARIETY NAME
Stephen Kresovich, Zachary W Brenton, and Richard E Boyles III	16FL159	CU16FL159

ADDRESS ***(Street and No. or RD No., City, State, Zip Code, and Country)***

317 Biosystems Research Complex
105 Collings Street
Clemson, SC 29634

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NOTE: Observations should be made on an appropriate number of well-spaced plants (approximately 15 cm spacing).

1. GENERAL CATEGORIES

1 Kind: 1 = Sorghum 2 = Sorghum X Almum 3 = Sudangrass 4 = Johnsongrass 5 = Other _____

3 Inbred Type: 1 = Male Sterile 2 = Maintainer 3 = Restorer

___ Male Sterile Cytoplasm: 1 = A-1 2 = A-2 3 = A-3 4 = A-4 5 = A-5 6 = Other _____

1 Use Class: 1 = Grain 2 = Forage 3 =Silage 4 =Sugar 5 = Syrup 6 = Broomcorn 7 = Multipurpose (specify)_____

2. MATURITY

___ 7 5 Days From Planting To Mid-Anthesis

___ 0 Number Days Earlier Than 4 1 = TX3042 2 = Wheatland 3 = TX2737 4 = TX430 5 = Redlan

___ 4 Number Days Later Than 5 6 = Other Public Line (Specify) _____

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3. PLANT

1 Coleptile: 1 = Green 2 = Red

3 Plant Pigment: 1 = Tan 2 = Red 3 = Purple 4 = Other (Specify) _____

4. STALK

2 Diameter (Main Stalk): 1 = Slim 2 = Mid-Stout 3 = Stout

5. STALK HEIGHT

1 4 1 cm From Soil To Top Of Panicle

9 cm Less Than 6 1 = TX3042 2 = Wheatland 3 = TX2737 4 = TX430 5 = Redlan

2 8 cm Greater Than 4 6 = Other Public Line (Specify) Sureno (PI 561472)

2 No of Recessive Height Genes Plant Height Genotype (Mark only recessive) : ___ dw1 ___ dw2 ___ dw3 ___ dw4

1 Waxy Bloom 1 = Present 2 = Absent

2 Tillers: 1 = Few 2 = Moderate 3 = Many

1 Sweetness: 1 = Sweet 2 = Insipid

2 Juiciness: 1 = Dry (Pithy) 2 = Juice

2 Panicle Exsertion: 1 = Short 2 = Medium 3 = Long

1 Degree of Senescence: 1 = Senescent 2 = Nonsenescent 3 = Intermediate

---

6. LEAF (First leaf below flag leaf)

2 Width (Relative to Class): 1 = Narrow 2 = Moderate 3 = Wide

2 Color: 1 = Light Green 2 = Dark Green

1 Margin: 1 = Smooth 2 = Wavy

2 Attitude: 1 = Erect 2 = Horizontal 3 = Drooping

1 Ligule: 1 = Present 2 = Absent

2 Midrib Color: 1 = White 2 = Intermediate 3 = Cloudy 4 = Yellow 5 = Brown

---

7. PANICLE

2 ANTHER COLOR (At Flowering) 1 = White 2 = Light Yellow 3 = Dark Yellow 4 = Wine

2 1 cm Panicle Length

9 cm Less Than 4 1 = TX3042 2 = Wheatland 3 = TX2737 4 = TX430 5 = Redlan

___ ___ cm Greater Than ___ 6 = Other Public Line (Specify) _____

3 Density: 1 = Open 2 = Semi-Open 3 = Semi-Compact 4 = Compact

2 Shape: 1 = Round 2 = Oval 3 = Cylindrical 4 = Conical 5 = Obovate

3 Length of Central Rachis (% of Panicle Length): 1 = 100% 2 = 75% 3 = 50% 4 = 25%

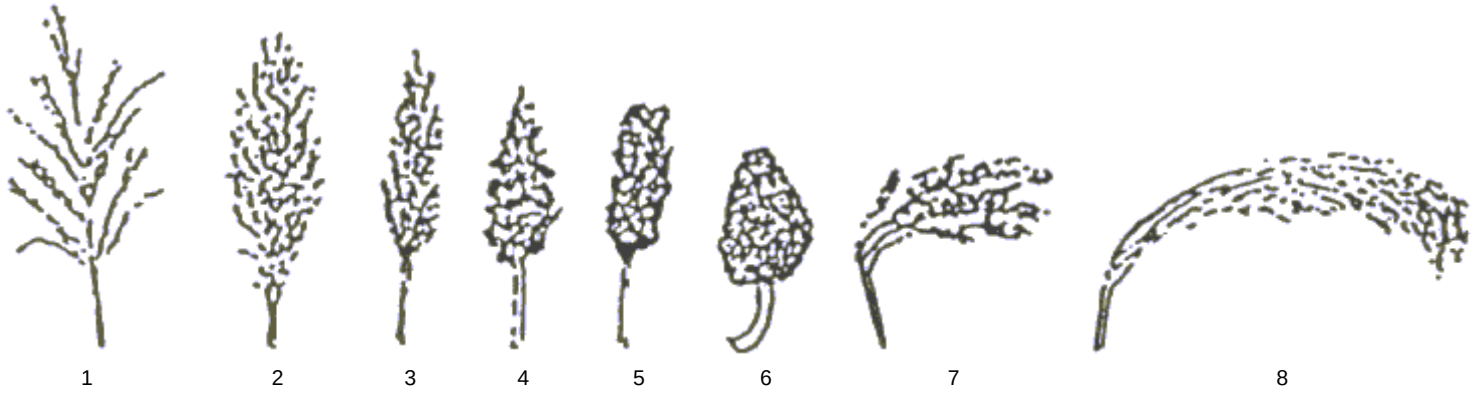
1 Rachis Branches (At Grain Maturity) 1 = Erect 2 = Horizontal 3 = Drooping

2 Rachis Branch Averag 1 = Short 2 = Intermediate 3 = Long

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7. PANICLE (Continued)

3 Panicle Type (Select Number from Diagram Below)



1 2 3 4 5 6 7 8

Glumes

1 Length: 1 = Short 2 = Intermediate 3 = Long

1 % of Grain Covered by Glume: 1 = 25% 2 = 50% 3 = 75% 4 = 100% 5 = Over 100%

2 Texture: 1 = Papery 2 = Intermediate 3 = Tough

6 Color (At Grain Maturity): 1 = Black 2 = Mahogany 3 = Red 4 = Sienna 5 = Dark Tan 6 = Light Tan

1 Hairiness: 1 = Smooth 2 = Intermediate 3 = Hairy

2 Venation: 1 = Present 2 = Absent

2 Transverse Wrinkle: 1 = Present 2 = Absent

1 Awns: 1 = Absent 2 = Short 3 = Intermediate 4 = Long

8. ROOTS

1 1 = Fibrous 2 = Rhizomatous

9. GRAIN

1 Testa: 1 = Absent 2 = Present

___ Testa Color: 1 = Brown 2 = Purple

1 Mesocarp Thickness: 1 = Thin 2 = Intermediate 3 = Thick

1 Epicarp Color (Genetic): 1 = White 2 = Lemon Yellow 3 = Red

1 Spreader (Tannin in Pericarp): 1 = Absent 2 = Present

1 Intensifier: 1 = Absent 2 = Present

___1 Grain Color (Appearance): 1 = White Pearly 2 = White Chalky (Opaque 3 = Yellow 4 = Lemon Yellow

5 = Light Red 6 = Dark Red 7 = Light Brown 8 = Reddish Brown 9 = Dark Brow

10 = Purple 11 = Other (Specify) _____

9. GRAIN (Continued)

1 Endosperm Color: 1 = White 2 = Yellow

1 Endosperm Type: 1 = Starchy 2 = Waxy 3 = Sugary

3 Endosperm Texture: 1 = Floury 2 = Intermediate 3 = Corneous

1 Seed Shape: 1 = Round 2 = Oval 3 = Ovate 4 = Turtleback

5 = Flat 6 = Wedge 7 = Other (Specify) _____

3077 No. of Seed per 100 G Genotype (if known): R, Y, I, Z, B1, B2, S, Tp, Wx, Fl

Define) _____

10. DISEASE RESISTANCE (1 = Susceptible 2 = Intermediate 3 = Resistant)

Bacterial Stripe, Charcoal Rot, Maize Dwarf Mosaic Virus, Puccinia (Rust), Bacterial Streak, Bacterial Spot, Anthracnose, Head Smut, Sooty Stripe, Downy Mildew, Grain Mold, Fusarium Stalk Rot or Others.

REACTION	DISEASE	CAUSAL AGENT	RACE OR PATHOTYPE
3	Anthracnose	Colletotrichum sublineola	
1	Grain mold	Fusarium spp.	

11. INSECT RESISTANCE (1 = Susceptable 2 = Intermediate 3 = Resistant)

Sorghum Midge, Chinch Bug, Greenbug or Others.

REACTION	INSECT	BIOTYPE
1	Sugarcane aphid	

12. MOLECULAR TRAITS

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13. OTHER DISTINGUISHING TRAITS

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EXHIBIT E - STATEMENT OF THE BASIS OF OWNERSHIP

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1. Name of Owner	2. Temporary Designation or Experimental Name	3. Variety Name
Clemson University	16FL159	CU16FL159

4. Does the applicant own all rights to the variety? Mark an "X" in the appropriate block. **If no, please explain.** [X] **YES** [ ] **NO**

5. Is the applicant a U.S. national or a U.S. based entity? **If no, give name of country.** [X] **YES** [ ] **NO**

6. Is the applicant the original owner? [X] **YES** [ ] **NO** **If no, please answer one of the following:**

a. If the original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. National(s)?
[ ] **YES** [ ] **NO** **If no, give name of country**

b. If the original rights to variety were owned by a company(ies), is (are) the original owner(s) a U.S. based company?
[ ] **YES** [ ] **NO** **If no, give name of country**

7. .Additional explanation on ownership *(Trace ownership from original breeder to current owner).*

PLEASE NOTE:

Plant variety protection can only be afforded to the owners (not licensees) who meet the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.

2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.

3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed the final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definitions.

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